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WATER SUPPLY & SANITARY IMPROVEMENT

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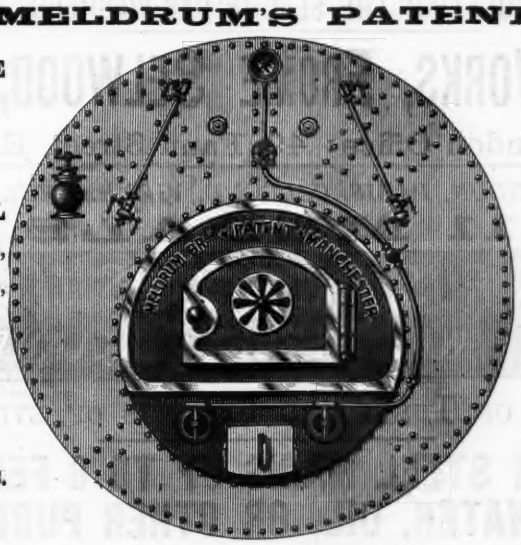

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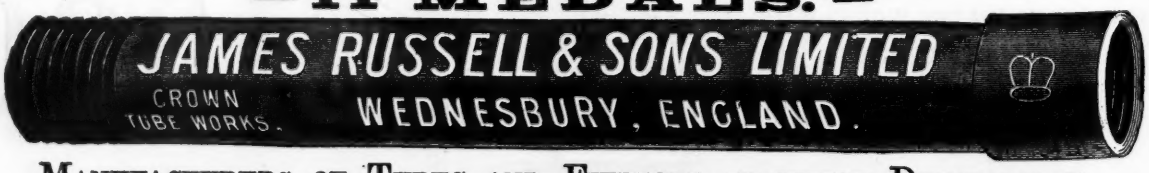

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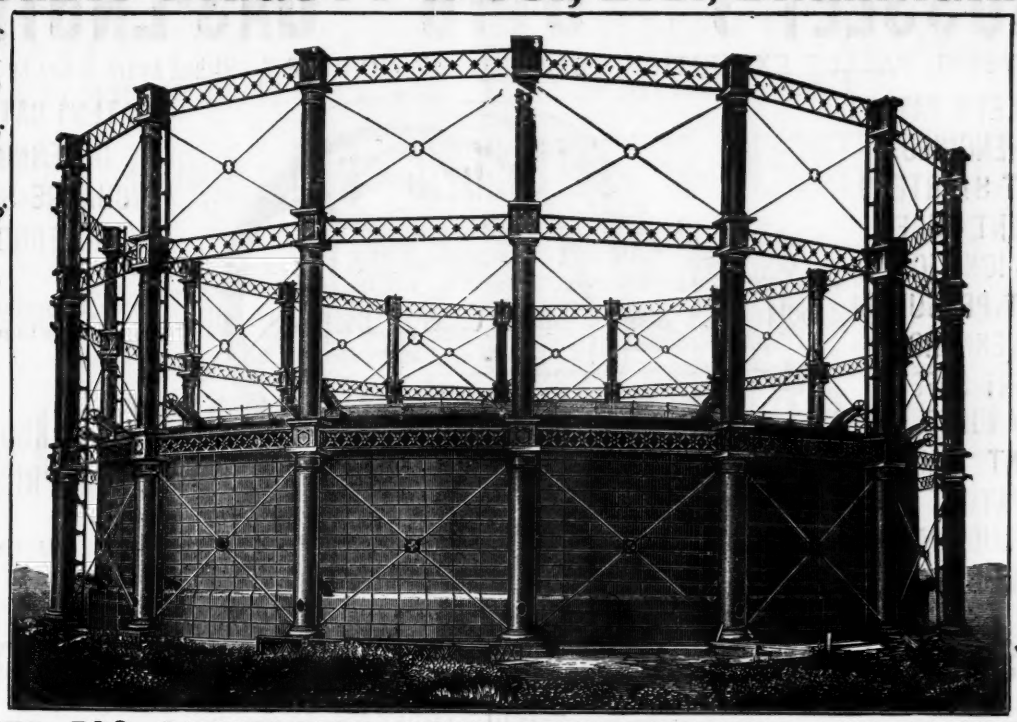

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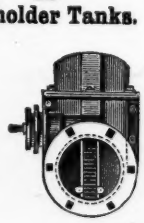

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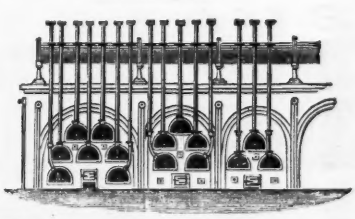

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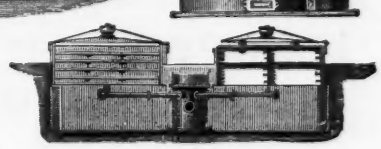

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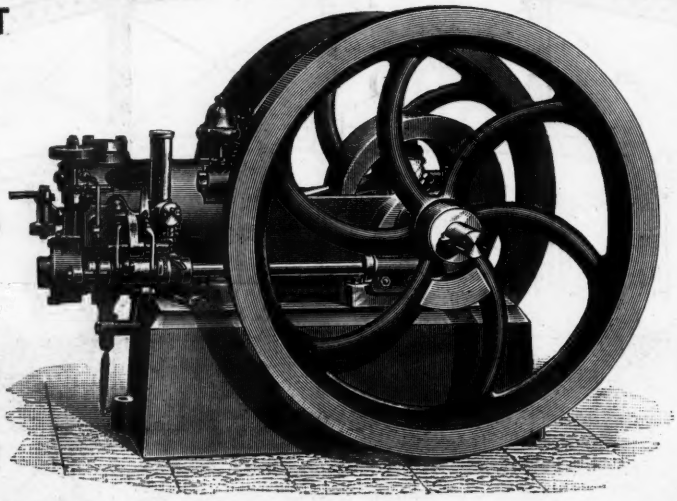

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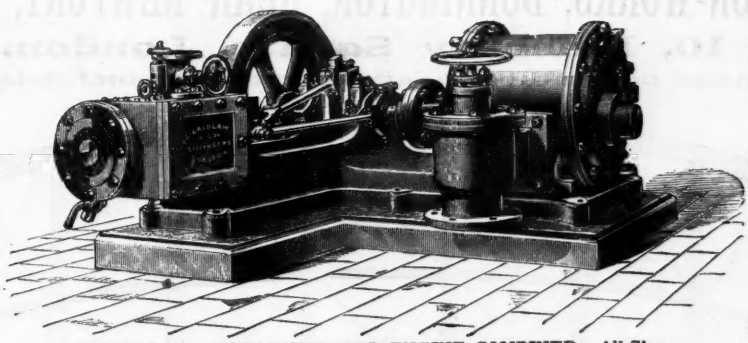

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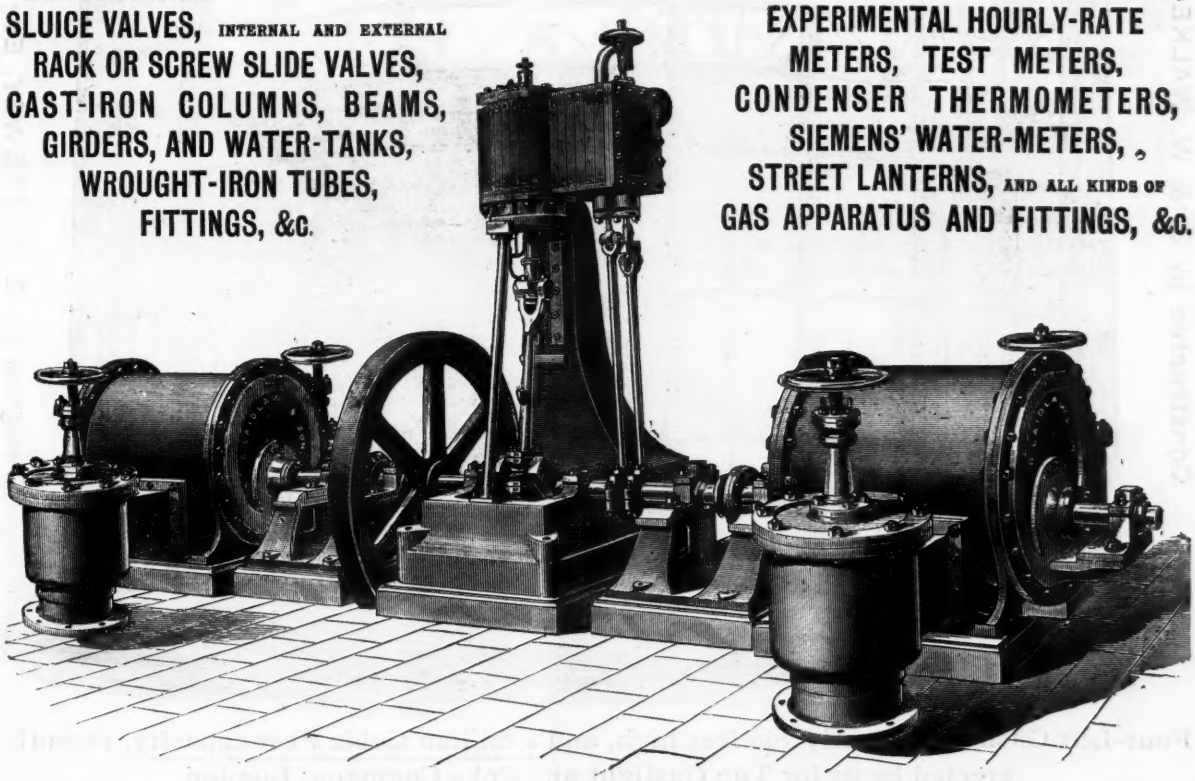

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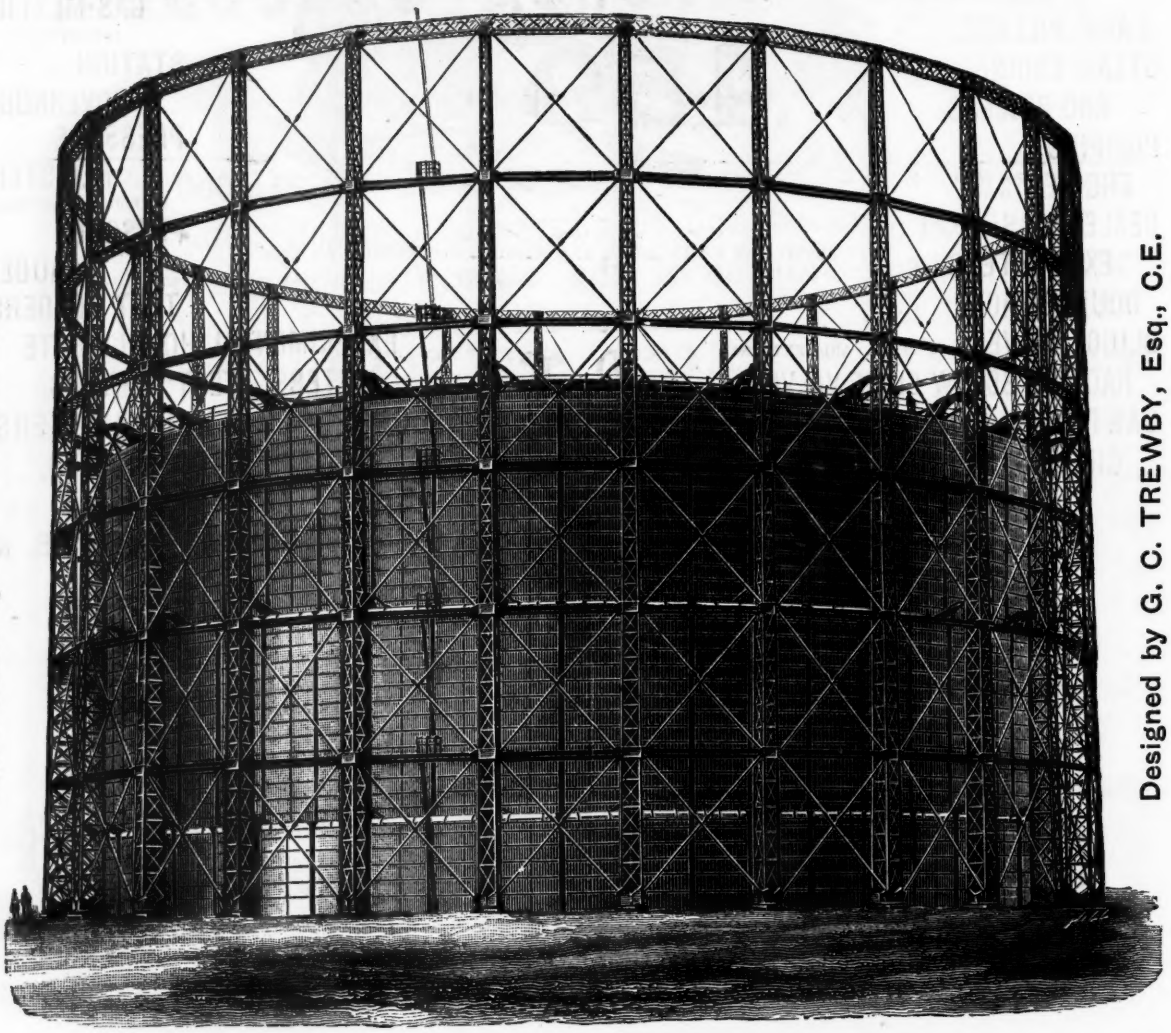

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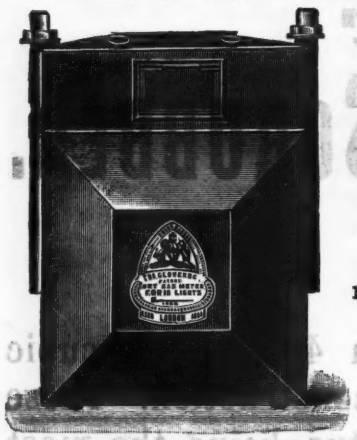

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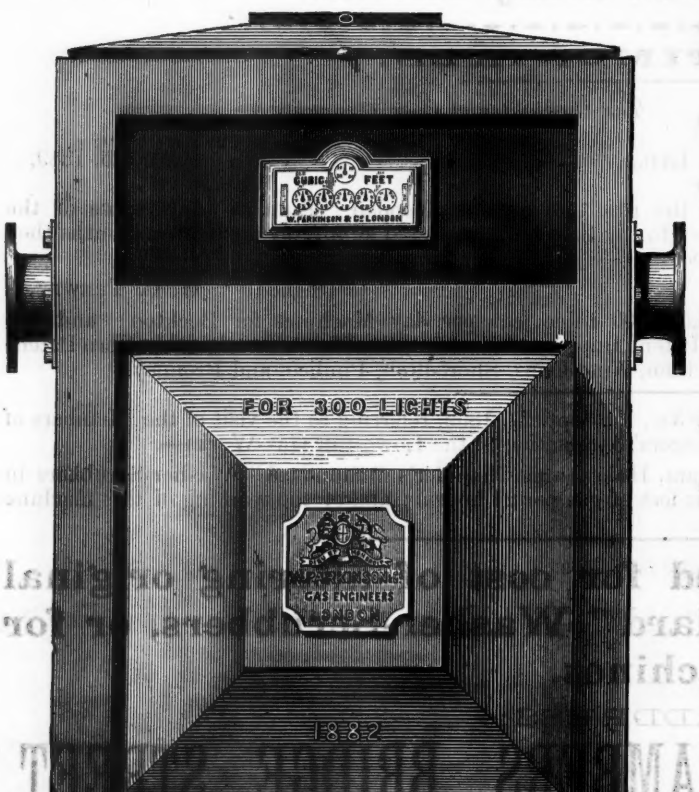

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 14, 1893.

The Gas Industry of the Country.

DURING the past few weeks we have published a large number of abstract reports of Gas Companies' meetings, and of meetings of Local Authorities owning gas undertakings, most of which possess local rather than general interest. They, however, furnish observers of the course of the gas industry in the United Kingdom with material upon which to base an opinion respecting the condition and prospects of the industry at large, which cannot be found elsewhere in the same concise shape. It is to be noticed with regard to the Gas Companies supplying Metropolitan suburban districts, that their increases, without exception, have been very large, notwithstanding the fact that the weather of the latter half of last year was not particularly favourable to them. We are not disposed, on principle, to make too much of climatic considerations as influencing gas consumption; believing that, while an exceptionally hard season may cause a heavy temporary draught upon gasholders, the sources of the constant expansion of the gas industry lie much deeper than in atmospheric changes. It would please us to say a good word to every provincial gas manager individually upon the evidences which come so plentifully to hand of the satisfactory work they are doing in the comparative privacy of their own districts. This, it is hardly necessary for us to point out, is impossible; and so we are compelled to congratulate the mass of our professional friends, according to the old saying, upon their happiness in having no history out of the common. Steady increases of business appear to be the rule; and as the present is an extremely favourable time for getting value for money, it is no wonder that structural work is brisk everywhere. There never was such a season for building gasholders and every other description of gas-works plant as that which is now opening; and a vast deal will be done in this respect by this time next year. Whether the high purchasing power of gold is a blessing or a curse to the community at large, there can be no question of its being satisfactory to those who are required to spend capital upon permanent and remunerative works.

There are in the country certain typical gas undertakings which serve as object-lessons for students and critics of the industry. Some, by reason of their injudicious outlay of capital, and consequent high selling price, are examples to be avoided. It would be cruelty to direct attention to these; nor would any real good be served thereby. It is much pleasanter, and more helpful, to notice the more happily situated undertakings. Take the Newcastle and Gateshead Company, for example. The Company are able to sell gas at the remarkably low price of 1s. 10d. per 1000 feet, less 10 per cent. discount; and though they could not make ends meet this time, it was not their fault, but was traceable to the deplorable strikes of the Durham miners and the engineers, which together cost the Company £11,500, added to which, of course, there was the depreciation in the value of residuals. This Company get about 1s. 3½d. per 1000 cubic feet for the gas used in the public lamps. Yet they have in their district a tolerably thriving Electric Lighting Company; which goes to support our view that in every town big enough and wealthy enough there will be a certain amount of patronage for electric light, as a luxury, whatever may be its price and that of gas in the same town. Bristol, again, is a notable place, by reason of the vicissitudes through which the gas undertaking has passed in the process of conversion from an old-fashioned to a modern concern. There is a good deal to be done here still; but the Company appears to ride more easily under the reconstructed capital account. Everywhere the favourable turn of the coal market is remarked upon; and if residuals still rule low, this will not matter so much when the raw material comes down to its natural proportionate value. We should like to be able to believe that residuals will advance considerably in the market; but we cannot "make the wish "the father to the thought" in face of the depression of trade or the appreciation of money, the favourable side of which has been acknowledged above.

The Spring Circular of The Incorporated Gas Institute.

THE usual spring circular of the Council of The Incorporated Gas Institute has been issued by the Secretary (Mr. W. H. Harvey). It is commendably hopeful in tone, and conveys the impression that no effort will be spared to make the Belfast meeting a success. Mr. Denny Lane, of Cork, will preside, which is as much as to say that the duties of the Chair will be discharged in a style that can only be fitly described as fascinating. The Lord Mayor and Corporation of Belfast, on behalf of the city, and Mr. James Stelfox, for the Gas Department, are going to make themselves very agreeable to the Institute, which is only what might be expected of Irishmen visited even by uninvited guests. The supply of papers promises to be

good; but members are asked to send a few more contributions to complete the programme. These must reach the Secretary's hands not later than May 13; and we hope he will get them all by this date. In the matter of excursions, the meeting is to be well favoured; the Friday being devoted to a trip to Portrush and the Giant's Causeway. Belfast is famed for many interesting and important industrial establishments, and some of these will be thrown open to members of the Institute and their friends. There is no doubt that those who can make their way to Belfast in connection with the meeting will be well rewarded for taking the pains of what, to many members, must, we fear, look like a long journey. It is to be hoped that this latter consideration will not be allowed to weigh too heavily with members hailing from the South and West of England. For residents in the North, Belfast is readily accessible; and for the rest—well, when one starts upon a day's journey, a hundred miles more or less does not greatly matter in these days of express trains and swift steamboats. One paragraph of Mr. Harvey's notification is to be specially commended to the attention of members of the Institute. It is the concluding one, in which he urges the claims of the Benevolent Fund upon those members—and they are too many—who have not yet become subscribers or donors to it. The honour of those who now compose the Institute is involved in the maintenance of this Fund in its pristine condition. The Secretary also asks members who may have books or pamphlets of an acceptable kind to spare, to remember the Reference Library.

Landlords Usurping the Power of Gas Companies.

A CURIOUS case, arising out of the cutting off, under peculiar circumstances, of the gas supply to a "flat," was heard last Thursday by Mr. Justice Collins, without a jury, and is reported in another column. The plaintiff was a resident at Manor Mansions, Belsize Park Gardens; and he occupied, under a lease for a term of 21 years, a residential flat for which he was to pay £80 a year, inclusive of the rates and taxes. Gas was supplied to the Mansions through a large meter at the entrance, and was carried to the different flats, every tenant of which had his own separate meter to register his private consumption. The price of gas in the district being at the time 2s. 9d. per 1000 cubic feet, the landlords, who collected the rental from the tenants, charged them 3s. per 1000 cubic feet, which this particular tenant refused to pay. The landlords thereupon cut off his supply; but they were ordered by a Judge in Chambers to restore it. They were now sued for damages for the inconvenience caused to the tenant by this alleged illegal proceeding; and an injunction to restrain them from repeating the interference was also asked for. The plaintiff succeeded in both respects; getting his injunction and 20s. damages, with costs on the higher scale. His case was simply that the landlords had no right to cut off his gas, which is a means of obtaining redress specially granted by statute to Gas Companies, in the public interest, and is not a privilege of landlords or lodging-house keepers. It was also argued that the question whether the landlords in this instance were reasonably entitled to make a surcharge of 3d. per 1000 cubic feet to their tenants upon the gas supplied by the Company was one which might have been tried in a County Court, and that to impose such a charge, and then cut off the gas if it was not paid, was an arbitrary proceeding. For the defendants, on the other hand, it was argued that they were responsible to the Gas Company for all the gas supplied to the Mansions, and the extra charge was put on to cover the service, expenses, and risk which they incurred by reason of their undertaking to supply their tenants at second hand. The question of the reasonableness of this extra charge was not decided by the Judge; but he expressed the opinion that the amount which might be demanded was that which the lessors would have had to pay if the gas-rate had not been excepted—which means the rental as charged by the Gas Company. As a matter of policy, it is undesirable that there should be any middleman between the Company and the consumer; and it is hard to see why a lessee of a flat rented at £80 a year should not be dealt with as directly as if he rented a separate house of the same annual value. It may be convenient for the tenants of flats in some cases to pay their gas-rental through their landlord; and then the amount of the charge, if any, which the landlord makes for this convenience may be fairly left to be settled between the parties. But even so, 3d. per 1000 cubic feet is a pretty profitable commission on such a transaction. It is, however, the way of some landlords of flats to put all sorts of petty extortions upon their tenants; and very possibly the rebellious gentleman in the instance under notice merely "kicked" at this gas surcharge as representing the proverbial "last straw." It is so far satisfactory to have it affirmed, on the authority of a Judge of the High Court, that nobody but the Secretary or other duly appointed officer of a statutory Gas Company can wield the thunderbolt known as "a cutting-off notice."

A "Surprise Visit" to New York.

AMERICAN gas affairs have perennial interest for us, for many reasons. In the first place, the attention of British capitalists known to have a liking for gas stocks is constantly being invited to the colossal possibilities of profit-making offered by the wholesale "deals" which figure so prominently in United States industrial finance. Secondly, it is instructive to watch how the gas industry thrives in a land where gas stocks, instead of being among the steadiest of investments, are quite as speculative property as mining shares. Lastly—although several other reasons might be cited—because the members of the gas engineering profession in the States are, almost without exception, the best of good fellows; and it is a real pleasure to follow their struggles with "trusts," "combines," state legislatures, boards of aldermen, "pirates," and all the multitudinous agencies that preserve for the United States the proud pre-eminence of having the dearest gas in the Universe. It must be admitted, however, that it is a little difficult to understand the game of the most eminent players with American gas properties. This admission will probably be accepted by the gentlemen in question as a compliment. One may peruse the newspapers—general and technical—with unflagging perseverance (albeit the effort is a little trying), and yet only pick up a few trivialities in the way of news. But meanwhile the big operators are working in the dark, and intelligence of their proceedings only transpires in the most casual way, when one is looking for something else. For example, it is left to the *Scientific American* and our own correspondent to furnish the details of the latest move of the United Gas Improvement Company upon the gas interest of New York. Goodness only knows how many times the New York Gas Companies have been united and split up, "raided," "watered," bought, sold, and consolidated. The last is the term they prefer for the present. Unless we are in error, however, their "strange, eventful history" is not yet ended in placid, dividend-earning prosperity. Somebody quarrelled with somebody else in New York a year ago, or thereabouts; and now we hear of a venture called the East River Gas Company, reputed to have been founded by the United Gas Improvement Company of Philadelphia upon the shore of the East River farthest from the city, to which water gas is to be carried through a tunnel under the river-bed. Works upon the Lowe system, with an eventual manufacturing capacity of 50 million cubic feet of gas per day, are being built upon a site convenient for the co-operation of the Standard Oil Company; and the gas will either be sold to the existing Companies in bulk, or these will be amalgamated upon terms favourable to the new comers. How romantic all this is! Can anyone fancy a gas company in England procuring a charter for establishing works on the other side of the Mersey, with the object of selling cheap gas in bulk to the Liverpool Gas Company; or the South Metropolitan Company running into The Gaslight and Coke Company's district by way of the Thames Tunnel? Certainly not. But how lively gas supply must be, as an investment and as a profession, where these things are not merely possible, but are done without the slightest disturbance of the surface of financial or industrial society!

The Use of Ammonia in the Household.

IT is a feature of the times that on every hand attempts are being made to establish business relations between the manufacturers of commodities and the general public of consumers. One cannot take up a newspaper without seeing advertisements directed to this object. Many articles in common use for which householders have been accustomed to go to retailers, are now to be had at first hand from makers and importers who a short time ago

would have disdained anything but the wholesale trade. This is especially to be noted in regard to commodities which, not being specialities, it is not worth the trouble of the shopkeeper to push in lieu of others to which a proprietary name has been given, and which yield better profits to the distributor. Thus many of our largest manufacturers of textile goods now do a great deal of private business, and are thus able to compete with shopkeepers whose interest it is to palm off cheap, foreign goods under attractive names. And even when the manufacturers of other kinds of commodities, such as chemicals, do not trade directly with the consumer, they are fain to remind the public that their products are still on sale, and continue to retain their well-proven qualities. As an instance, we may cite the action of the soda-crystal makers; and the general practice of Gas Companies in advertising coke for sale is similarly to the point. Experience has also demonstrated the existence of local markets for sulphate of ammonia, when the means of supply is adapted to the demand. More than this, however, can be done for ammonia. This article, suitably prepared, is of great use as a cleansing agent for domestic use; and we direct the attention of gas managers to this field, which has hardly yet been opened up. Roundly stated, there is perhaps a possibility of creating as great a town demand for ammonia as that which it shares with other sources of nitrogen for agricultural purposes. What has been and is being done for borax, in this respect, is equally possible for ammonia. This idea is not to be dismissed as a mere triviality, for every fresh outlet for the increasing national output of ammonia should be followed up to the uttermost for the sake of the gas industry. It is also due to the community that every agency for increasing the sum of health and comfort by lightening household labour and facilitating the attainment of cleanliness should be cultivated for whatever it may be worth.

The Rating of Machinery Bill.

That "hardy parliamentary annual," the Rating of Machinery Bill, has been read a second time once more by a large majority of the House of Commons; and nobody affects to believe that it will meet with a better fate this year than has attended it hitherto. It will simply drop, and will come on again next year as fresh as if it had never been heard of before. There are many rather strange things about our parliamentary system; and any intelligent foreigner who should be curious on the subject of the illogical checks which exist in this system for the prevention of too rational legislation, might be recommended to study the parliamentary history of this particular Bill. Everybody admits that the actual English practice of assessing property for the relief of the poor is full of anomalies and inconsistencies; and that the consequent burden of rating falls very unequally indeed upon different interests. Yet an attempt to remove one of the anomalies, which recommends itself to a large majority of the House of Commons, somehow never gets any farther. All that supporters of the Bill can do is to reintroduce it year after year, and support it with arguments from which the bloom has been worn by long handling. It is opposed year after year upon the same old grounds, which are not sufficient to ensure its rejection, but are apparently strong enough to block its progress. Little did the Chard Union Assessment Committee think that they were rendering themselves immortal, when they made a manufacturer who had obtruded his machinery into an agricultural district pay rates upon it. Yet their action seems destined to rank among the unforgettable achievements of the century. Parliaments come and go; administrations are formed and scattered; smart paragraphists find (or create) new butts and bores among honourable members to replace the old. But once a year, without fail, the same Rating of Machinery Bill is solemnly brought in, gravely discussed, approved by a handsome vote, and—never heard of for the rest of the session. And yet there are those who say that Britons are, on the whole, a *triste* people. In reply to this reproach, it may be asked whether any other people have ever succeeded in importing so much dry, subtle humour into their legislative arrangements as lies in our treatment of this one measure.

Mr. Walter A. Sapey has been appointed Manager and Secretary of the Tamworth Gas Company—a position held by his father, the late Mr. E. Sapey, for 15 years.

WATER AND SANITARY AFFAIRS.

In the evidence given by Dr. Frankland before the Royal Commission on the Metropolitan Water Supply, we meet with a statement which may be said to comprehend, in a few words, the entire scope of the inquiry. In reply to Professor Dewar, who asked that he would "summarize," for the information of the Commission, his views as to the prospects of the London Water Supply, Dr. Frankland replied: "I would summarize my views "by saying that, in my opinion, there is, in the Thames "basin, an ample supply of excellent water for the wants "of the Metropolis for the next hundred years at least, "and that there is no necessity to go outside it." The phraseology includes both the rivers and the subterranean waters. If Dr. Frankland's conclusions simply had reference to the water obtainable by further operations in the chalk, the question of the river supply would be left in an extremely dubious state. But there is no room for apprehension on this score. "The public need have no fear," said Dr. Frankland, "if the water was properly filtered, "of epidemic disease being produced from river water; "and with filtration as carried out in London they need "not be apprehensive of any epidemic of cholera in "the Metropolis this year." Hamburg is mentioned as now constructing filters according to the method employed in London. The value of storeage capacity, as well as proper filtering arrangements, is dwelt upon by Dr. Frankland, considering that "the great obstacle" the London Water Companies have to contend against consists in the flood waters. The quality of the water supplied to the Metropolis is described as simply dependent on the pains taken to render it good. Here comes in the question of expense. General Scott, the Official Water Examiner, in his evidence before the Commission, said he was inclined to think that the circumstances in which the Water Companies had been placed of late years "rather militated against the extension of works." The Companies "had been in doubt as to the ultimate fate in "store for them." We may here observe that the kind of spirit in which the Companies are met is shown by the determination of the London County Council to seek the rejection of the East London Water Bill, instead of simply dealing with the clauses. The Companies are to be hampered in every way, so as to prevent the due extension of the supply. The warning voice of Sir John Lubbock is raised in vain; and war against the Water Companies is to be maintained at Spring Gardens, despite any peril to public interests.

While speaking approvingly of the river water, as supplied in the purified form, Dr. Frankland looks to the chalk for the increase of the Metropolitan Water Supply in the future. But there was evidence enough from other witnesses to show clearly that both the Thames and the Lea were capable of being drawn upon to a larger extent than hitherto. Mr. Hawksley was able to speak for the Thames; and his views were endorsed by Mr. C. J. More, the Engineer to the Conservators. Mr. W. B. Bryan, the Engineer to the East London Water-Works Company, submitted data showing the capability of the River Lea to yield water over and above what is being taken from it at the present time. In his later evidence before the Commission, Mr. Dibdin, the Chemist to the London County Council, explained that he did not object to the formation of storeage reservoirs in the valley of the Thames, providing proper measures were taken to exclude certain forms of pollution. He complained that "gross sewage" was going into some of the tributaries of the Thames, and into the streams which flow into these tributaries. If storeage reservoirs were formed, it was imperative that means should be adopted to exclude all sewage. "There are "plenty of means for keeping it out," said Mr. Dibdin, "and disposing of it in a harmless manner." In reference to the actual supply now given by the Water Companies, he bore witness to the great improvement which it had undergone during the last fifteen or eighteen months. He saw no reason whatever why this standard should not be maintained, and not only so, but still further advanced. After such testimony, it is a little amusing to read the evidence of Mr. R. Bodmer, the Public Analyst for St. Saviour's and Bermondsey, who complained that on certain occasions the water supplied by the Southwark and Vauxhall and Lambeth Companies was "unfit for a public supply." Mr. Bodmer ventured to

hope that the Commissioners would draw the same conclusion as himself on this point. But he certainly failed to convince one of their number—Professor Dewar—who put a series of questions to Mr. Bodmer, showing that, in respect to the quality of the water supplied to the Metropolis, the latter was hopelessly at variance with such authorities as Dr. Frankland, Mr. Crookes, Dr. Odling, Mr. Dibdin, and the late Dr. Tidy. Mr. Bodmer virtually condemned the Southwark and Vauxhall supply of the 2nd ult. because it contained 0·013 grain of albuminoid ammonia per gallon, and the Lambeth because it had in it 0·011 grain. The oxygen required by the former water was 0·128; and by the Lambeth, 0·111. On the other hand, Mr. Dibdin gave analyses of water containing 0·012 of albuminoid ammonia, and absorbing 0·13 of oxygen; while, in neither case did he suggest that the water was at all unfit for drinking. This reference to a standard disposes of any question as to the identity of samples. Of course, Mr. Bodmer may have his own standard; but it must be clearly understood that such is the case when he ventures to declare that certain samples of London water are "decidedly impure, and require but little more to be condemned as unfit for drinking." We may also refer to the analyses of Mr. Dibdin as showing that the London Water Supply within a recent period has undergone a diminution of 33 per cent. in the organic element, and 50 per cent. in respect to albuminoid ammonia. With the evidence of General Scott, to which we have adverted, the examination of witnesses by the Royal Commission terminated, and we have now to await the report, which we may expect to find will prove the most important of any that has yet been presented on the subject of the Metropolitan Water Supply.

Coal in Essex.—It is reported that a seam of coal was found last Saturday week, at Great Coggeshall, at a depth of between 1400 and 1500 feet.

Mr. D. Wills has been elected a Director of the Sittingbourne Gas Company in place of Mr. W. Porter, who has retired after holding the position for a long time.

Institution of Civil Engineers.—At the last monthly ballot for membership of this Institution, Mr. Alfred Fidler, of the Borough and Water Engineer's Department, Blackburn, was admitted an associate member.

Manchester District Institution of Gas Engineers.—In the report of the general business at the meeting of this Institution on the 4th inst., as given in the JOURNAL last week, the name of Mr. G. Niven, of Cleckheaton, was given instead of that of Mr. J. Niven, of Clayton, near Bradford, as one of the newly-elected members of the Committee.

Resignation of Mr. W. Mackenzie, of Dunfermline.—We regret to learn that, owing to continued ill-health and weakness, Mr. William Mackenzie, Manager and Secretary of the Dunfermline Gas Company, has been compelled to relinquish his position, which he has filled for the past 27 years. Reference is made to this matter by our Scotch Correspondent in his "Notes" to-day.

Issue of Debenture Stock in the Lambeth Water Company.—A short time ago the Directors invited tenders for £25,000 of 4 per cent. debenture stock, applications for which were to be sent in by Monday last week. They amounted to upwards of £59,000; and the stock has been issued at an average price of £128 16s. per cent., or £28 16s. premium. Tenders at less than £128 10s. were not considered.

The Smoke Abatement Movement.—Our readers may remember that one of the earliest Bills to be introduced into Parliament for several succeeding sessions was that brought forward by Lord Stratheden and Campbell for the abatement of smoke. His Lordship's decease on Jan. 21 last would, it was thought, imperil the cause he had so much at heart. This, however, is not likely to be the case; for by his will, dated Nov. 16, 1892, he gives the control of the Bill, which, it is stated, "has been sanctioned by the House of Lords, and has undergone accurate revision," to the Duke of Westminster and his coadjutors.

Solid Air.—Our readers are already acquainted with the extraordinary communications which Professor Dewar has lately made to the Royal Society on the subject of the liquefaction of the atmosphere. Last Thursday he brought before that body a further development of his experiments. He has now succeeded in freezing air into a clear transparent solid, the precise nature of which can only be settled by further research. It may be a jelly of solid nitrogen, containing liquid oxygen; or it may be a true ice of liquid air, in which both oxygen and nitrogen exist in the solid form. This doubt arises from the fact that Professor Dewar has not been able, by his utmost efforts, to solidify pure oxygen, which, unlike other gases, resists the cold produced by its own evaporation under the air-pump. Nitrogen, on the other hand, can be frozen with comparative ease.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 472.)

BUSINESS in the chief markets of the Stock Exchange was reduced to a very low volume last week; and there seemed to be less disposition than ever to deal upon any considerable scale. The tendency was rather to await the course that affairs in America might take. Argentine matters also attracted attention. At home, fine weather favourable for traffic assisted rails, but not to such an extent as would have been the case if no "Rates Question" were looming ahead. Various other markets were affected by special causes—*e.g.*, breweries, by the Local Veto Bill. The Money Market was agitated by the anticipation of the issue of United States Gold Bonds; and Consols eased down. But they closed firmer, as the probability of the issue receded. While other markets have been so much below their normal degree of activity, the Gas Market has exhibited decidedly more animation than it has done for the last few weeks. The tendency on the whole was good. Several more or less considerable advances in quotation are to be noted; while only one movement of significance is adverse. And the reason for this isolated instance is not apparent on the surface, seeing that the closing price at which business was done was the best of the week. Gaslight "A" was as steady as a rock. It was done every day at close figures, ranging only from 223½ to 224½, with one bargain near the close at a quarter of a point better. There was a renewed large demand for the secured issues; and the debenture stocks and the 10 per cent. and 6 per cent. preferences commanded high figures. There was more doing in South Metropolitans, and prices were steady; but "B" (the instance noted above) was lowered 1. The advance in favour of Commercials made further progress; all three issues having improved in value. The Suburban and Provincial Companies also were more animated—especially Brentford; but nothing moved. Among the Continentals, Imperial was strong and active; and the rest were quiet and firm, without change. The South American contingent was rather depressed. Buenos Ayres showed a falling off; but the remainder were unaffected by any variation. Water stocks have been somewhat irregular in their movements; the most noteworthy feature being the steady advance in debenture issues.

The daily operations were: The Gas Market opened firm, and remained steady through Monday; the only moves being a rise of 1 in Gaslight 4 per cent. debenture, and a fall of ½ in Buenos Ayres. The tendency on Tuesday was much the same as the day before. There was no change in gas; but Lambeth Water fell 2. Wednesday was firm and steady; all prices being well maintained. Business was rather quieter on Thursday; but good figures still prevailed. Commercial old rose 1; ditto new, 5; and ditto debenture, 3. South Metropolitan "B" receded 1. Prices ruled strong again on Friday, and Gaslight "K" rose 1½; but there was a fall of 1 in Buenos Ayres debentures. In Water, New River debentures rose 2½; and Grand Junction, 1. Saturday's prices showed a favourable tendency, though Gas quotations did not move. In Water, Lambeth fell 1; but ditto debenture rose 2; and West Middlesex, 3.

ELECTRIC LIGHTING MEMORANDA.

Woodhouse and Rawson Affairs—Electric Lighting in Chelsea—A Board of Trade Inquiry at Brighton.

THE publication of the report of the Woodhouse and Rawson Investigation Committee, which was considered at a stormy meeting of shareholders this day week, serves as a reminder that we have not yet heard the last of the speculative element in the electrical business. It will be remembered that, at the general meeting of the Company in November, a very alarming state of things was disclosed; and it was only by strenuous efforts that the Company were kept afloat pending the issue of this inquiry into the circumstances and prospects of the concern. It has now been made manifest that the attempt to work an electrical financing business under cover of an ostensibly industrial trade, which has been the object of all the Woodhouse and Rawson permutations and combinations, has failed disastrously. The present Company was formed in 1889 by the purchase of several companies from Messrs. Woodhouse and Rawson, Limited, who were the vendors, for £269,000. The vendors stated that they had been carrying on a very profitable business; and, as an inducement for the public to subscribe, they undertook to guarantee the new Company a dividend of 15 per cent. on the ordinary shares for three years, depositing £75,000 as a guarantee. This arrangement was effected by simply leaving £75,000 of the purchase-money unpaid. At the end of the first financial year (1890), the Directors reported a net profit of £61,085, out of which the promised dividends were duly paid. There was no explanation of how these profits were arrived at: and the Committee now say that they included a considerable proportion of very doubtful items, which should not have been carried to profit and loss at

all, and were certainly not legitimate trading profits. Then the guarantee fund was given up, on the assurance of the Directors that it was not required. The following year dividends were again paid, on the pretence of profits being made which are now shown to have existed only on paper. Last year Nemesis came; but even then the Directors did not tell the shareholders all. The Company's manufacturing interests have been "utterly neglected and shamefully mismanaged, while the Managing Director has devoted his energy to hunting financial will-o'-the-wisps," according to the damning statement of Mr. Squire, the Chairman of the Investigation Committee. It is not to be wondered at that Mr. Pope, Q.C., as one of the Directors, should say "he wished he could run away and hide his head, in the face of the report of the Committee."

The annual general meeting of the Chelsea Electricity Supply Company has been held under the presidency of the Chairman (Mr. J. Irving Courtenay), when the Directors' report and the statement of accounts were passed, and a dividend after the rate of 2½ per cent. was declared on the ordinary shares. Of the total capital of £80,585, however, the large proportion of £33,700 is in the form of debentures, the interest on which amounts to considerably more than the nominal profit available for dividend. Even so, the capital account is overdrawn. It is to be observed also that a "proportion" of rent, rates, taxes, and management expenses is charged to capital, which makes the profit balance on revenue account of £4318 to this extent (whatever it may be) a matter of book-keeping. It is a fact, however, that the Company earned £12,523 last year, and score an increase of 27 per cent. in the number of lamps on circuit. Their increase in units sold is not quite so large—being 23 per cent.; showing that the additional lamps are not used so freely as the first comers. The Chairman claims that the capital expenditure of the Company per lamp connected is only £2 6s. 6d., which would compare favourably with the capital outlay of any other central station company. It is intelligible that the Chelsea Company should show a little solicitude on this score, seeing that their system of supply is a peculiar one, and involves the use of accumulators to an exceptionally large extent.

We have had previous occasion to remark upon the contest between the Corporation and the local Hammond Company for the profit of the electric lighting of Brighton. Last week the opposing parties had a field-day before two Board of Trade Inspectors, who were appointed to hold a local inquiry with reference to the application of the Company for a Provisional Order, which was opposed by the Corporation. The Company had down Mr. Castle, Q.C., and the Corporation retained Mr. Fletcher Moulton, Q.C., and Mr. W. L. G. Boxall; and there was a strong corps of experts engaged on each side, besides a number of skirmishers who claimed to hold "watching" instructions from a variety of interested parties. Mr. Castle did his best to show that the Electric Lighting Company is really a genuine affair, supplying a public need; and the experienced Mr. Robert Hammond himself appeared as a witness to sustain this position, and to repel the suggestion that his Company merely wanted to be bought out by the Corporation. Mr. Moulton knows something about the supply of electricity, and also about the Hammond Companies, which he described as having a "monotonous history." An amusing point was made in the course of the cross-examination of one of the Company's customers, who said he had given up taking the electricity supplied by the Corporation because the meter registered 20 per cent. against him—as tested at Mr. Hammond's notorious Electrical Standardizing and Testing Institution. The Corporation naturally desire to prevent the Hammond Company, who at present supply a number of consumers by means of overhead wires, from getting a permanent hold of the same districts in which the underground mains of the public undertaking are laid. It was easy for Counsel for the Company to show that up to the present time the Corporation venture has been a costly, and not a particularly paying one; but this is no reason why a competing speculative concern which is practically at the last gasp should now receive that statutory protection which was refused to it in 1889. If, as is alleged, Brighton has never taken Mr. Hammond's speculation seriously in satisfaction of its desires for electric lighting, it is rather late in the day for him to invoke the aid of the Board of Trade to invest his Company with a degree of consideration which it does not deserve on its own merits.

Potts' "Mining Register and Directory for 1893."—We have received a copy of the fifth annual edition of the useful book of reference issued under the above title by Mr. W. J. Potts, Colliery and Nautical Publisher, of North Shields. It was originally projected as a guide to the coal and iron trades of the United Kingdom; and it has been the aim of the publisher to make each succeeding edition more useful in this respect than its predecessor. The work includes a valuable series of geological maps, prepared at Mr. Stanford's well-known establishment, and inserted by special permission of the author of "Hall's Coal-Fields of Great Britain." There is also an article on "Colliery Managers and their Organization." It is claimed for the work that it has attained the position of a thoroughly reliable directory for the special industries above mentioned; and the claim appears to be well founded.

THE MUNICIPALIZATION OF GAS SUPPLY IN AMERICA.

It has on more than one occasion been a subject of comment in these columns that there is in the United States a school of public men—they would not think it flattering if we described them as politicians—who uphold the doctrine that public works in that country should be carried out by private or joint-stock enterprise, instead of by local authorities, by reason of the wastefulness, inefficiency, and corruption of the latter. This school has an organ in the magazine *The Forum*, to the November number of which Mr. Joseph Chamberlain, M.P., contributed an interesting comparative statement of the working of the municipal institutions in Birmingham and Boston, Massachusetts, showing that the latter city spends more than six times as much money for management as Birmingham. We do not now propose to deal further with Mr. Chamberlain's essay, but to follow an answer published in the American *Review of Reviews* by Professor E. W. Bemis to the challenge of another writer in *The Forum* "to point out any American city where any municipal work is done so economically or so well as similar work is done by private individuals." For this purpose, Professor Bemis selected the example of gas supply; and as definite information concerning the cost of making and supplying gas in American towns is rather scarce, we will give in abstract form what this authority has to say respecting the working of the few municipalized gas undertakings of the United States. Those referred to by Professor Bemis are only ten in number, of which four are in small towns, and only two—in Philadelphia and Richmond respectively—are in really large cities. Thus there is reason for the observation, by way of preface, that if the municipal ownership of gas-works is a good thing under the conditions prevailing in the United States, as Professor Bemis would have us believe, the faith is not very widely held.

It is stated that, with the exception of several cities where the authorities started gas-works upon their own initiative (as was done in Philadelphia in 1841, and in Richmond eleven years later), there was much dissatisfaction with the quality or price of the supply furnished by the private companies, which led to their being bought out. It is claimed that the price of the municipalized gas is lower than that sold by the companies, with few exceptions. In the city of Wheeling, West Virginia, which has 35,000 inhabitants, and is evidently Professor Bemis's model municipal example, gas is sold at a profit for 75 cents per 1000 cubic feet. He says upon this head that the only city which gets its gas at anything near this rate, besides Cleveland, where the price has recently been forcibly reduced by ordinance to 80 cents, is Terre Haute, where a war of rates between two competing concerns has brought the price of gas for the time being down to 35 cents. It is remarked that in a similar gas war at Kokomo, Indiana, "one company was giving away its gas during the last quarter of 1892." The observation is made, however, that "no instance is on record of where such competition has not been followed by consolidation and a rise of prices." And yet the people tolerate such insensate proceedings.

The illuminating power of the gas—mostly all coal gas except in Philadelphia, where 40 per cent. of the output is water gas—ranges from 17 to 19 candles. From this we judge the coal to be pretty good, and lime purification to be general. Although selling at low rates, the municipal works are said to pay well. Philadelphia makes a profit of 20 per cent.; Richmond, 18 per cent.; and Wheeling, 11·6 per cent. on the gas-works, after largely providing for extensions out of revenue. The leakage rate of American gas-works appears to be high; averaging but little under 12 per cent. Philadelphia, being far and away the biggest place in Professor Bemis's list, ought to furnish his most telling example, if bulk were everything in a gas undertaking. It has a population of 1,046,964, and has supplied its own gas for upwards of fifty years. Unhappily for the ratepayers and gas consumers, for forty-six years prior to 1887 the administration of the undertaking was vested in irremovable trustees, who made the establishment the milch-cow for the political party that happened to be in the ascendant. The Trust was a focus of corruption; the gas supply was bad and dear; and the undertaking was loaded with a mountain of debt. This system was changed in 1887; and now the works are managed upon rational principles.

The chief data relating to the Philadelphia working are as follows: Coal costs $4, or 16s. 8d., per ton. The net cost of gas at the consumer's burner is 76 cents, or 3s. 2d., per 1000 cubic feet, subject to capital charges; and $1·50 per 1000 cubic feet is charged for it. The city buys its water gas from a private company for 37 cents, or 1s. 6½d., per 1000 cubic feet in the holder. The leakage in Philadelphia is 14·72 per cent. Professor Bemis gives the following remarkable explanation of the high selling price of gas in Philadelphia: "The price of gas is kept at $1·50, because the unusually large number of small house-owners in Philadelphia, on whom the burden of local taxation now falls, in the absence of any taxation of the rich, desire relief from taxes." There is a good lesson in social economy to be extracted from this extraordinary statement; but we have no time to do it just now.

Professor Bemis's model town of Wheeling supplies some striking statistics. Here coal costs only $1·64, or 6s. 10d., per

ton; and tar and coke fetch more per 1000 cubic feet than the cost of the coal. The cost of gas at the consumer's burner is consequently down to 29·5 cents, or 1s. 2¾d., per 1000 cubic feet, which leaves a handsome margin on the 75 cents, or 3s. 1½d., per 1000 cubic feet charged to the consumer. All the gas required for the public lighting is given gratis. Although, as Professor Bemis admits, coal is exceptionally cheap in Wheeling, it is only a little dearer in most cities east of the Mississippi. At the little city of Bellefontaine, Ohio, which has 4238 inhabitants, a variety of water-gas plant known as the Askins process has been put in to make 126,000 cubic feet of 22-candle gas per day, at a cost of something less than 20 cents (10d.) per 1000 cubic feet in the holder. In this plant there are two generators. In the first one, crude Lima oil, after the rate of about 5 gallons per 1000 cubic feet, at 1¼ cents per gallon, is fed into a bed of incandescent coke, underlying heated soft coal, which supplies it. Steam is admitted at the bottom of the generator; and the resultant product is passed over into the second generator, where it meets water gas resulting from the passage of steam through incandescent coke. The mingled vapours and gases are then converted into illuminating gas by passing through intensely hot retorts. A somewhat similar plant, known as the Kendall process, is being introduced into the city-owned gas-works at Hamilton, Ohio—a place of 17,565 inhabitants. As Professor Bemis says, the results of the working in these two places, being open to public investigation, will be watched with interest.

It is to be noted that, with the exception of Philadelphia, the average rate of increase of gas consumption in the places catalogued by Professor Bemis is 9 per cent. per annum. He remarks upon this point that "a somewhat similar yearly increase is taking place everywhere, and should be kept in mind by those who believe that electricity is destined to displace gas. The fact is that the illuminating power of gas and its cheapness of manufacture are keeping pace with the development of electric lighting. For every 10 feet of gas displaced by electric light on streets, and in halls, stores, and some residences, 11 or more feet of gas are used in other residences or for fuel. People accustomed to brighter streets at night turn up the gas higher when they come home."

An instructive feature of Professor Bemis's work is his novel way of writing down, as the true capital value of any gas undertaking, the estimated cost at which the plant could be duplicated on the instant. All the rest is a burden resting only upon the strength of the monopoly, whatever this may be. He is accustomed, of course, by such examples as that of Terre Haute and Kokoma—and it might also be said, of Boston and New York—to regard a gas undertaking as a business as liable to the stress of competition as any other. Hereupon he remarks that "in competitive business, where no very rare business talent is embodied, the value of the plant is, in the long run, the cost of duplication. If a person or corporation is earning more than the average profits on the cost of duplication in a competitive business where no great risks are run or no very high order of ability is required, others will construct rival works, and by competition in selling the product force down the profit to the normal rate on this cost of duplication. The value of the plant will then fall to the cost of duplication. In a monopoly like gas, where no very high order of ability is needed, and where there are no very great risks, the excess of capital over the cost of duplication—which in cities of more than 100,000 inhabitants is likely to range from $2·50 to $3·50 per 1000 cubic feet of gas sold—is a pretty good test of the monopoly profits." This argument needs a little more elaboration. What the author means to say is that if a gas undertaking could be set up with new plant, "lock, stock, and barrel," for a figure under that at which its capital actually stands in relation to its business, it is the monopoly, and the monopoly only, that protects the excess from being confiscated. This is a hard rule; and it is not quite a fair one, although there is some force in it. The difference between the amount of the capital upon which a gas undertaking pays interest and that at which new works could be had at current prices, may be large or small; it may also be legitimate or the reverse. We agree with Professor Bemis, that it is a suggestive figure to get out for the purpose of comparison; but we doubt whether it is expedient to put a "cast-iron" rule upon the subject into the hands of people who do not understand these things. It is quite true the onus of protecting this difference of capital outlay, whatever its proportion may be, rests on the monopoly; and this foundation is not eternal nor unattackable, whether it is a statute of the Imperial Parliament or a permit from highway authorities to lay mains in roads. The nearer the capital burden approaches the cost of renewal or duplication, the safer the undertaking; for it is obvious that, monopoly or no monopoly, a business that returns an ordinary rate of profit upon a capital sum just sufficient to enable it to be properly carried on in the particular locality, has nothing to fear from other capital. There can be few cities, however, in any part of the world where capital sunk in gas supply does not appear large if judged from the standard of what it would cost, after knowledge gained, to duplicate it. Moreover, an old gas undertaking necessarily preserves the memento, in its capital, of all the fluctuations in prices of commodities and money that it has passed through. These records cannot be wiped out as it were with a wet sponge whenever gold appears to appreciate, or coal and iron to fall. Still, we take Professor Bemis to witness that those who unduly inflate the capital of gas undertakings do so at their peril. Monopoly is a good horse; but it is possible to ride him to death. It is satisfactory to learn from Professor Bemis that, although gas companies in the States occasionally indulge in mutually ruinous competition, he has discovered only one instance of a local authority setting up gas-works without previously buying out the local company; and in this case the company proved impracticable. Even so, however, the existence of a private competing company in the town gave the authorities a great deal of trouble, and plunged both parties into much tedious, costly, and unnecessary litigation. The experiment is not likely, therefore, to be repeated.

The Transactions of the Incorporated Institution of Gas Engineers.—We have received from the Secretary (Mr. T. Cole, Assoc.M.Inst.C.E.) a copy of the second volume of the Transactions of the Incorporated Institution of Gas Engineers, just published by Messrs. E. and F. N. Spon. It is a thick volume of 222 pages of letterpress, with many large plates. We shall take an early opportunity of reviewing the book, which is much more than a record of the proceedings at the May meeting of the Institution.

The Electric Lighting in the City.—It having been reported to us that on this day week 34 of the electric arc street lamps in the western district of the City of London Electric Lighting Company, Limited, went out shortly after midnight, and were not relighted for the rest of the night, whereby the district was plunged in darkness (no notice being given that the gas-lamps would be wanted), we addressed an inquiry on the subject to the Secretary of the Company, in order that any explanation of the collapse that might be forthcoming might appear with the statement; and we have been informed that the extinction was due to a short-circuit caused in one of the mains by the night stokers inadvertently tipping hot ashes over the conduit, which melted the insulation at this spot.

A Successful Artesian Boring into the Chalk near London.—The valley of the Wandle, in the district of Tooting, has long been known for its overflowing artesian wells; but the numerous borings in the chalk of the London basin have of late years considerably reduced the levels of the springs, so that most of them have ceased to overflow. That this source of supply is, however, still copiously fed from the outcrop of the chalk, has just been forcibly demonstrated by an artesian well which has been bored by Messrs. Le Grand and Sutcliff, of London, at a spot midway between Wimbledon and Tooting. The depth is 166 feet, reaching about 30 feet into the chalk formation. Upon penetrating into this, the water rose 17 feet above the ground; and the overflow at the surface is at the rate of no less than 22 tons per hour.

The Iron and Steel Industries of the United States.—The progress of the iron and steel industries of the United States during the last 20 years is the subject of an official report by Mr. Swank, of the American Iron and Steel Association, which has lately been published by the Department of the Interior. The production of iron ore has risen from 3,031,891 tons in 1870 to 14,591,178 tons in 1891; the average annual imports of iron ore during the last twelve years were only 719,300 tons. The production of pig iron increased from 2,546,713 tons in 1872 to 9,157,000 tons last year. The manufacture of steel has also increased rapidly in the United States. In 1860 the total production was 11,838 tons only; in 1890 it had reached 4,277,071 tons. Between 1872 and 1891 the production of Bessemer steel increased from 120,108 tons to 3,657,107 tons; that of open-hearth steel, from 3000 to 649,323 tons; and the total of all kinds of steel, from 160,108 to 4,372,749 tons. Up to 1883, Great Britain was the leading steel-producing country in the world; but in that year the United States took the first place.

Japanese Coal.—An examination of the bitumen of Japanese coal has recently been conducted by Mr. Watson Smith, who communicated the results of his researches to the last meeting of the London Section of the Society of Chemical Industry. The Müke mines in the south-west of Japan furnished the sample examined. The coal of that district is remarkable for its large quantity of bituminous matter; as much as 9·5 per cent. of bitumen being obtained by extraction with benzene, whereas Boghead cannel, by similar treatment, yields only 0·6 per cent. The ash of the coal contains the unusually high proportion of 42 per cent. of lime. The bitumen consists mainly of hydrocarbons of the paraffin series; but from the portion boiling at about 150°C., a small quantity of the nitro-derivative of an aromatic hydrocarbon (probably xylene) can be obtained. The existence of phenols and nitrogen bases in small quantities in the higher boiling fractions is demonstrable; and a slight bromine absorption shows that the unsaturated hydrocarbons likewise are present in inconsiderable amount. The medium fractions resemble unrefined burning oil in character and smell; while the higher fractions show traces of paraffin scale. Mr. Watson Smith concludes that the coal is an advanced bituminous lignite of the tertiary formation, which has not been subjected to such extremes of heat and pressure as the ordinary or secondary coals. Paraffins would be expected to result from slow destructive distillation, at a low temperature, of the resins and waxes of plants and trees. A more complete analysis of the bitumen of this remarkable lignite will be given shortly. The coal is stated to be excellent for steam-raising purposes.

NOTES.

Tunnelling the East River, New York, for Gas.

In the concluding portion of the article on "Gas Affairs in Brooklyn," contributed by our American Correspondent, which appears in another part of the JOURNAL issue to-day, reference is made to the scheme of the East River Gas Company—an undertaking recently formed with power to do all sorts of things—for sending gas into New York, from an out-town station. Plans have been made for building and equipping the works according to the system of the United Gas Improvement Company; and the first section, for the production of 6 million cubic feet of gas per day, has been started. In order to get the gas into New York, a tunnel 2400 feet long will be required, in which will be placed one 48-inch and two 36-inch gas-mains. An illustrated description of the method of carrying out the tunnelling works has recently appeared in the *Scientific American*. The tunnel is being cut in solid gneiss rock 10 feet by 8 feet in section, with an arched roof. This is larger than is required for the gas-mains; but other services are to be rendered by the tunnel. The Company have already, it seems, been offered $10,000 a year for twenty years as rental for the accommodation of a pneumatic tube. "It is also among the immediate possibilities," says the above-named publication, "that the East River Gas Company may, in accordance with its charter, develop into a great generating company for gas and power of all kinds, notably for illuminating gas and electric power. The immediate idea is, if possible, to sell gas to existing Companies in the city, or to acquire the property of those Companies. The effects of such operations would be that the storeage and use of naphtha within the city limits would be stopped." This is the excuse offered to the public for the proceedings of the Company.

Moissan's Electric Furnace.

Mention has already been made in this column of the so-called electric furnace of M. Moissan, which is simply a small furnace constructed of quicklime, so arranged that it can be powerfully heated from within by an electric arc. It now appears that the object of the arrangement is the ready preparation of large quantities of refractory metals, for which the furnace is found to be well adapted. For this purpose a quantity of magnesia, which is perfectly stable even at the high temperature attained in the apparatus, is first placed in the cavity of the furnace, and upon this the crucible of retort carbon containing a mixture of powdered carbon and the metallic oxide to be reduced. When the metal is volatile, a current of hydrogen is passed through the furnace; and the vaporized metal is condensed in a separate receiver. In this manner M. Moissan has succeeded in rapidly preparing considerable quantities of the metals of the alkaline earths, calcium, strontium, and barium. If the metal is not sensibly volatile, it is left in the crucible after the reduction in the form of an ingot. The rare metal, uranium, and the metals manganese and chromium, belong to this category. M. Moissan has obtained uranium in the form of a bar exhibiting a brilliant fracture and great hardness. It possesses the peculiar property of sending forth a shower of incandescent sparks when struck against a piece of porcelain, or when fragments of it are shaken about in a glass flask; reminding one of the combustion of freshly-reduced iron when allowed to fall through the air. Manganese is easier to reduce from the protoxide than uranium; but chromium is difficult to deal with.

The Connection of Lightning Conductors with Gas or Water Mains.

It is acknowledged that the best way of "earthing" lightning conductors is to connect them with gas or water mains; but it is important that the connection should be good, in order that there shall be no trouble at this point in the event of a heavy discharge. Herr Müller, of Darmstadt, sends to the *Journal für Gasbeleuchtung*, a description of an arrangement of this kind which is recommended as cheap, reliable, and easily applied. The end of the conductor is wrapped once round the main-pipe, and secured in place by means of a clamp made in halves, and bolted together. The conductor passes up through a hole in the upper half of the clamp. When this is fixed, the whole thing is packed round with clay, and run in solid with lead, after which a coating of asphalte is applied to make a neat finish. The connection has been tested by Dr. Kittler, who found the resistance to be less than 1-1000th of an ohm. It is, of course, wholly a question of obtaining and preserving, between the lightning conductor and the pipe, a clean metal connection large enough to carry off any charge that the conductor itself can withstand.

A Strange Light.

A remarkable kind of light has been successfully exhibited by Dr. Philip Lenard, of Bonn, and has formed the subject of a paper read before the Royal Prussian Academy of Sciences at Berlin. Hertz has shown that the rays which proceed from the cathode of a Geissler tube, and are capable of exciting phosphorescence, will permeate thin metal. If then it were practicable to find a sheet of metal foil thick enough to be air-tight and opaque, yet thin enough to be permeable by this discharge, it would be possible to allow these rays a passage into the open air by closing an opening in a discharge-tube with such a piece of foil. This idea has been realized by Dr. Lenard by means of an ingeniously arranged apparatus and a hammered aluminium plate 0·003 millimetre thick. This plate forms in the apparatus in question a shutter which Dr. Lenard calls the "window," because, while quite impermeable to air and light, it allows the rays from a cathode at a distance of 12 centimetres to penetrate it freely. These rays render the air faintly luminous. A halo of bluish light surrounds the "window," and is moderately bright only on its surface. At the same time a strong odour of ozone is recognizable. Substances capable of phosphorescence, if held near the "window," shine with their peculiar light on the side nearest to it. All the phenomena of phosphorescence cease if a magnet is so applied to the discharge-tube as to repel the cathode rays from the inner side of the "window." The atmosphere is a dull medium for the cathode rays to penetrate; coal gas is more permeable, and so is hydrogen; while oxygen and carbonic acid are less permeable than air.

COMMUNICATED ARTICLES.

POWDERED COAL IN GAS-WORKS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

In a "Note" on "Coke from Powdered Coal" which appeared in the JOURNAL for Jan. 24 last (p. 138), it was stated that "no record exists of the effect of pulverizing coal upon its gas-making qualities. Dust coal was formerly objected to by gas managers, mainly on account of the difficulty of keeping up retort heats with it. With the use of gas furnaces, however, there can be little force in this traditional objection."

It is some 13 years since I tried the effect of using finely-ground coal, with a view of manufacturing a good quality of furnace coke. These experiments were carried out at a small gas-works, with a bed of three 15-inch round retorts, as in regular use for the production of gas; and, as far as possible, under similar conditions as to temperature of distillation. A level gauge was maintained at the hydraulic in each case; the registration of the station meter was taken every hour; and the results were calculated out to "per ton" for convenience of comparison. The same class of coal was used in both experiments; but it should be noted that the ground coal was prepared from "small," and not from the sample as used. It will be seen from the table below that the screened coal could be worked off in six hours, or at the rate of four charges per diem, yielding 15,600 cubic feet of gas; whereas the ground coal could only be worked at the rate of three charges per diem, yielding 9010 cubic feet. The consumption of fuel, and the labour, would be practically the same in each case. A considerable increase in the yield of coke, and also a great improvement in quality, was obtained from the ground coal. It was apparently equal to good furnace coke. But the reduced yield per ton and make per mouthpiece showed conclusively that the ground coal was entirely unsuited for ordinary gas-works operations. No improvement in the quality of the gas produced followed with the diminished yield.

Make of Gas.	Small, Ground to Powder. 2¼-cwt. Charges.	Screened Gas Coal. 2¼-cwt. Charges.
First hour	620 cubic feet.	1600 cubic feet.
Second hour	960 "	1960 "
Third hour	1440 "	1880 "
Fourth hour	1500 "	1880 "
Fifth hour	1590 "	1640 "
Sixth hour	1410 "	1440 "
Seventh hour	990 "	stopped.
Eighth hour	280 " stopped.	
Total make per ton	8790 cubic feet.	10,400 cubic feet.
Coke	15¼ cwt.	13¾ cwt.
Production per day—		
9 charges = 20¼ cwt.	9010 cubic feet.	
12 " = 30 "		15,600 cubic feet,

From this it would appear that the traditional objection is well founded. Even if the results had been satisfactory, it would be impossible to work the ground coal in the usual way. After introducing three charges with the scoop, the air was opaque with dust, and the stokers were covered with it, and suffered considerable discomfort. No flame issued from the retort when the charge was put in; and the temperature was so far lowered that the meter did not move at all for several minutes after the introduction of the charge.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(*Continued from p.* 311.)

Influence of Temperature and Atmospheric Conditions upon the Volumes of Gases.

It was pointed out in a previous article* that the temperature at which gas is measured affects the registration. Although this matter is not considered *in practice* in connection with the station meter, the subject of the measurement of coal gas would

* See Vol. LIX., p. 1058.

not be complete without a full reference to the effect of atmospheric and other conditions on the volumes of gases. Moreover, it is a matter which must be taken into account and allowed for in the more accurate indications of the test-meter of the photometer-room and the laboratory; the allowances being embodied in the tables of "Tabular Numbers" of Appendix C to the Metropolitan Gas Referees' "Instructions."

Gases, unlike solids, are highly elastic, and readily susceptible to variations in temperature and pressure, which result in corresponding changes in volume. The relation existing between volume and pressure, with reference to gases, is stated, in what is known as Boyle's or Marriott's law, as follows: The volume occupied by any gas is inversely proportional to the pressure to which it is subjected. Thus, other conditions being equal, volume 1 under pressure 1 becomes under pressure 2, volume $\frac{1}{2}$; volume $\frac{1}{4}$ under pressure, 4; volume 3 under pressure, $\frac{1}{3}$; volume 5 under pressure, $\frac{1}{5}$; and so on. Or volume 1 under a barometrical pressure of 30 inches of mercury becomes under a pressure of 29·5 inches—as 29·5 : 30 :: volume 1 to volume 1·016; and at a pressure of 30·5 inches—as 30·5 : 30 :: 1 volume to 0·983 volume.

All bodies expand more or less by heat. The fraction which expresses *the extent of this expansion* for every 1° rise of temperature, *as compared with the bulk occupied at freezing-point* (0° C. or 32° Fahr.) is termed *the coefficient of expansion*. All perfect gases may be considered (for practical purposes) to have the same coefficient of expansion, which is as follows:—

(*a*) For every rise of 1° centigrade, an increase of 0·003665, or 1·273rd of the volume occupied at 0° C.

(*b*) For every rise of 1° Fahr. an increase of 0·002036, or 1·460th of the volume occupied at 32° Fahr.

Note.—When calculating upon the Fahrenheit scale, the student must always remember to deduct 32 from the given temperature.

Thus, 273 volumes at 0° C. become 273 + 1 = 274 volumes at 1° C., and 273 + t at t° C. Similarly, 460 volumes at 32° Fahr. become 460 + (33 − 32) = 461 volumes at 33° Fahr., and 460 + (t − 32) at t ° Fahr.

Example 1.—What will 100 volumes, measured at 30 inches barometrical pressure and 60° Fahr., become when measured at 29·5 inches and 70° Fahr.?

Let x be the volume required; 460 volumes at 32° Fahr., become 460 + (60 − 32) = 488 volumes at 60° Fahr.; and 460 + (70 − 32) = 498 volumes at 70° Fahr. Therefore, as 488 (as measured at 60°) is to 498 (as measured at 70°), so is 100 (as measured at 60°) to x (the required volume as measured at 70°). Now, 100 volumes, measured at 30 inches pressure, will be more when subjected to 29·5 inches pressure, hence—

$$\text{As } 488 : 498 :: 100 : x$$
$$\text{As } 29{\cdot}5 : 30 :: 100 : x$$

$$\therefore x = \frac{498 \times 30 \times 100}{29{\cdot}5 \times 488} = 103{\cdot}78 \text{ volumes.} \quad (\textit{Answer.})$$

Example 2.—What will be the corrected volume (measured at 30 inches pressure and 60° Fahr.) of 100 cubic feet of gas consumed when the barometer and thermometer are for the time being recording 30·1 inches of pressure and 68° temperature respectively?

Let x be the volume required; 460 volumes at 32° Fahr. become, as already shown, 488 volumes at 60° Fahr., and 460 + (68−32) = 496 volumes at 68° Fahr. Therefore—

$$\text{As } 496 : 488 :: 100 : x.$$

And at 30 inches pressure the volume will be greater than at the higher pressure of 30·1 inches. Hence—

$$\text{As } 30 : 30{\cdot}1 :: 100 : x.$$

$$\therefore x = \frac{488 \times 30{\cdot}1 \times 100}{496 \times 30} = 98{\cdot}7 \text{ cubic feet.} \quad (\textit{Answer.})$$

Now, applying this calculation to an ordinary photometric test, we substitute 5 cubic feet for the 100, and find that the 5 cubic feet measured during the test under the existing atmospheric conditions would, if measured at 30 inches pressure and 60° Fahr., have only been registered as—

$$\frac{98{\cdot}7 \times 5}{100} = 4{\cdot}935 \text{ cubic feet.}$$

If, therefore, this latter quantity only has passed through the photometer meter, instead of 5 cubic feet as registered, the photometric readings, indicating the amount of light emitted from this 4·935 cubic feet of gas, must be less than would have been the case had the stipulated 5 cubic feet passed through, at the standard conditions; and the average of these readings must be corrected accordingly. Suppose they stood at 17·64 candles. Then if 4·935 cubic feet per hour give a light equal to 17·64 candles, what would 5 cubic feet per hour give?

$$\frac{5 \times 17{\cdot}64}{4{\cdot}935} = 17{\cdot}87, \text{ the corrected illuminating power.}$$

But our correction is not yet complete. As is well known, there is always present in the atmosphere more or less moisture, or water vapour, which plays an important part in the economy of Nature. The higher the temperature of the atmosphere, the more vapour it can hold in suspension; and as the temperature lowers, the vapour condenses in the form of dew or rain. Water, and even ice, when exposed to the atmosphere, give off steam, or aqueous vapour, at all temperatures. This power is termed the *elastic force* or *tension of aqueous vapour;* and, in the exercise of this force, more or less influence is exerted on the surrounding atmosphere—an influence which is exerted upon the barometer itself, and indicated in the readings thereof, and the extent of which has been carefully ascertained by experiments which need not be here detailed. Below, however, are given the results of these experiments, by which it will be seen that, in order to ensure accuracy in the corrections made, certain deductions in the barometric readings have to be made, in accordance with the extent of this elastic force as at the time indicated. The experiments referred to (and repeatedly confirmed) show that, at the temperatures named, the tension of aqueous vapour in inches of mercury is (Fowne's "Inorganic Chemistry") as follows:—

Temperature Deg. Fahr.	Deg. C.	Tension in Inches of Mercury.
32	0·0	0·200
40	4·4	0·263
50	10·0	0·375
60	15·5	0·524
70	21·1	0·721
80	26·6	1·000
90	32·2	1·360
100	37·7	1·860
110	43·3	2·530
120	48·8	3·330

Due allowance for this tension is provided for in the tabular numbers already referred to, which are calculated from the following formula:—

$$n = \frac{17{\cdot}64\ (h - a)}{460 + t}$$

Where h is the height of the barometer in inches, t the temperature on the Fahrenheit scale, and a the tension of aqueous vapour at t. If v be any volume at t temperature, and h pressure, and V the corresponding volume at 60° and 30 inches, then $V = v\,n$.

Now let the student refer to the table of tabular numbers, and try for himself how the formula is worked upon. Suppose a test has been made when the barometer and thermometer stood at 30·5 inches and 70° respectively, what figure will represent the necessary correction?

$$a \text{ (at } 70°) = 0{\cdot}721$$
$$h = 30{\cdot}5$$
$$t = 70°$$
$$\therefore \frac{17{\cdot}64 \times (30{\cdot}5 - 0{\cdot}721)}{460 + 70°} = 0{\cdot}99$$

The student should thoroughly familiarize himself with this matter, and work out numerous examples for himself. The matter is perhaps a somewhat difficult one to deal with as lucidly as the writer would desire; and while he trusts that he has been sufficiently explicit to enable the reader to thoroughly grasp the subject, he would be pleased to have brought under his notice any special points of difficulty that might not have been cleared up.

GAS AFFAIRS IN BROOKLYN (N.Y.).

By Our American Correspondent.

Gas matters in Brooklyn—so generally known as the "City of Churches"—have lately assumed a very confused and befogged aspect. In fact, there are so many "wars and rumours of wars," so many reports of "deals" and "combines," and such profuse denials of such negotiations, that the outsider who attempts to unwind the bewilderingly twisted skein is well-nigh compelled to pause in his perplexity, and give up the task as hopeless. And yet the present condition of gas affairs there is but the natural outcome of the methods which have prevailed for years in the conduct of these things in that city, which is also styled the "sleeping-room of New York City." The past history of gas matters there is analogous to that in a great many cities in America. First a company is formed to supply gas; then outsiders, becoming jealous at its success, start another, ostensibly with the object of competing with it. The public hails with outspoken approval the birth of the new concern, thinking it will mean for them cheaper light. Then comes the "bicker" between the old-established company and its new competitor; and the latter, instead of fighting the former, buys a territory of it, and settles down to earn dividends rather than indulge in the unpleasant, unprofitable sport known as a gas war. Let the reader extend this principle by the subsequent addition from time to time of other competing companies which do not compete; and he will have the history of gas affairs in Brooklyn, and, in fact, in many other cities. Thus it came about that, up to some 15 years ago, there were six Gas Companies—viz., the (old) Brooklyn, the Nassau, the People's, the Citizens', the Metropolitan, and the Williamsburgh. But then the Fulton Municipal Company was formed, it was generally understood, in the interest of the Standard Oil Company. Thereupon the usual history of gas wars was repeated; for, after a lively conflict, we find the Fulton Municipal Company arranging with three of its competitors to supply gas to them wholesale, at what was considered a very high figure, and accepting from its greatest competitor a very large sum as a reward for keeping out of its territory. In this way it came about that, though there have been seven Companies actively engaged supplying gas in Brooklyn, three of

them did not manufacture it, but took their supply from the water-gas works of the Fulton Municipal Company.

For a while everything was happy and peaceful, until, in 1887, the Legislature passed a law to the effect that the price of gas in Brooklyn should be $1·25 per 1000 cubic feet. For some time there was much grumbling by the owners of gas stocks, particularly the holders of shares in those Companies which were buying gas wholesale, for their margin of profit on which to pay for distribution and meet capital charges was reduced to a very small figure. Eventually the Companies accepted the inevitable with such sweet composure as they could assume; and matters pursued the even tenor of their way, to be broken a few months ago by Mr. Addicks, who is so well known in connection with the history of the Bay State Gas Company of Boston. This gentleman looked carefully over the field, and was not slow in seeing that the work done by seven Gas Companies could be performed fully as well by one, and that the saving thus effected in management would of itself be a fair dividend. This much having been decided, his next move was to attempt to get command of several of the Companies; but subsequent experience has shown this to be a difficult task. Mr. Addicks has obtained a controlling interest in the Brooklyn Gas Company; and has been elected President of that corporation. He subsequently tried to bring the other Companies into a combination scheme. This, however, not being successful, he has endeavoured to buy the stock of some of the other Companies. But the holders, thinking Mr. Addicks wanted the various properties very badly, and would take them at any figure, have so marked up their goods that he is quoted as saying that the situation has no interest for him. One of his first offers was to the Metropolitan Company. It was generally supposed that this concern would be ready to sell, for the reason that its contract with the Fulton Municipal Company, whereby the latter supplied it with gas in bulk, is just about running out; and it was intimated that, unless the Metropolitan people renewed the contract, the Fulton Company would open war upon them, as their territories were adjacent, and it was felt that such a fight would lead the Metropolitan Company to accept any reasonable offer. Here, however, subsequent facts did not bear out surmises.

It is generally understood, though no authoritative figures have been given, that Mr. Addicks offered $127 to $130 for the stock, which was about $10 a share more than the previous quotations; but the offer was declined. Perhaps this can, in part, be explained by the fact that some Brooklyn and New York people have felt that, if one Syndicate with the avowed object of controlling gas matters was a good thing, then two or three would be better; and hence Mr. Addicks has had to contend not only with the existing stockholders, but with other Syndicates. How many, probably no one knows; for the history of the last few weeks has indicated that two or more Syndicates, starting out from apparently opposite quarters, and seemingly working in conflicting directions, have not appeared at times to be opposed to each other so seriously as was supposed. In fact, some people say that two of them are separate in name only. This much seems to be a fact—that another Syndicate, outside the one represented by Mr. Addicks, made an offer for the control of the Metropolitan Company, and that the offer was subsequently withdrawn.

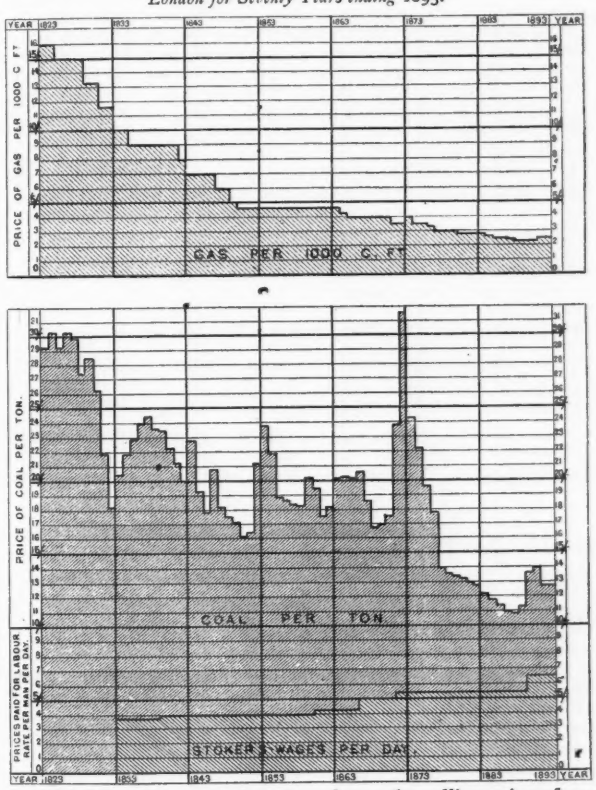
In the meanwhile, an interesting fight has been going on at one end of Brooklyn between the Williamsburgh and Equitable Gas Companies. The latter has some mains laid and works built, but has been restrained by the Courts from commencing operations. Whether the injunction will be continued, whether the Company will be allowed to compete with the Williamsburgh Company, or whether Mr. Addicks will get control of the concern, is among the uncertainties of the future. The situation of affairs is interesting; and it is made more so by the project of some large capitalists who have secured a charter, under the title of "The East River Gas Company," with the object of erecting extensive plant on Long Island, and supplying gas in bulk to any of the Companies of New York City, and possibly also of Brooklyn. It should be explained that New York City and Brooklyn run along in general parallel lines, divided by the East River, and that Brooklyn is on Long Island; and it is also worthy of note that the gas used in New York is made at several works in the city proper—generally in very cramped quarters, and in districts where real estate comes high, and seems to offer an important barrier against any extensions of plant. Now, the scheme of the East River Gas Company is to put up plant at Ravenswood, on Long Island, above Brooklyn, and then to tunnel the East River, and thus convey gas into the holders of the different Companies in New York City. It is held that the gas can be made much more cheaply in one large factory than in the many smaller ones in the city; and also that the Companies there, by stopping the manufacture at the several works, will be enabled to sell their real estate, or large portions of it, and that the interest on the money thus obtained will be an important source of yearly revenue. With these plans in mind, the projectors of this novel enterprise speak of putting up works having a daily capacity of 50 million cubic feet. That this plan would result in a large saving in the cost of manufacture can readily be accepted; but the drawback to the scheme is the cost of tunnelling the East River. It is certainly a unique idea to expend about a million dollars in making a tunnel for the use of gas-mains only. Possibly it may not come to so much but it is assuredly difficult to figure accurately in advance the cost of such work. However, the projectors have the courage of their convictions. This undertaking may be found to have an important bearing on the gas question in Brooklyn; and possibly we may yet see a "combine of combines," and a colossal works at Ravenswood making the gas used both in New York and Brooklyn.

TECHNICAL RECORD.

THE COST OF COAL AND LABOUR AND THE PRICE OF GAS.

In the course of the Inaugural Address delivered by Mr. W. R. Chester at the recent meeting of the Manchester District Institution of Gas Engineers, as given in the JOURNAL last week, he referred to the gradual diminution which has taken place in the selling price of gas during the past seventy years. He pointed out that this did not represent a corresponding decrease in the cost of the raw material; for, while this had diminished 50 per cent., the selling price of gas had gone down 85 per cent., and this decrease had been coincident with a rise of wages of between 70 and 80 per cent. Mr. Chester had prepared a diagram showing this graphically; but it was not available at the meeting. He has, however, since forwarded it to us for incorporation in our report of the proceedings; and we reproduce it below:

DIAGRAM *showing the Variations in Prices of Gas, Coal, and Labour in London for Seventy Years ending* 1893.



The above diagram is based, so far as the selling price of gas and coal is concerned up to 1877, on one prepared by Mr. W. J. Warner, and given by him in his Inaugural Address to the British Association of Gas Managers in 1879.* The figures for the years since 1877 are those of the South Metropolitan Gas Company; the cost of wages being taken from the evidence given by Mr. George Livesey before the Royal Commission on Labour in May of last year, and reported in our columns the following month.

MR. IVISON MACADAM ON THE BURNING OF GAS.

At the Meeting of the Glasgow and Scottish Section of the Society of Chemical Industry last Tuesday, Mr. W. IVISON MACADAM read a paper on "The Relative Value of Coal Gas when Consumed from Different Burners and under Various Pressures." Its principal portions were as follows:—

During some investigations on the quality of the Edinburgh gas supply, the results obtained led me to conclude that, while the quality of the gas was good, the excessively high pressure on the mains caused improper combustion in the houses. This high pressure is stated in "The Statistical Report of the Gas Supply of Scotland from July 31, 1890, to Aug. 1, 1891,"

* See JOURNAL, Vol. XXXIII., p. 934.

issued by the Committee of the North British Association of Gas Managers, to be: Maximum high pressure on mains, governor outlet—Edinburgh, 44-10ths; Leith, 22-10ths. Day pressure on mains, governor outlet—Edinburgh, 12-10ths; Leith, 5-10ths. After passing my experimental meter, however, I find the day pressure to be from 18-10ths to 16-10ths. I need not consider why this excessive pressure is put on at the Edinburgh works; but it is possible that the mains are now becoming too small for the demands made upon them, and that it is necessary to accelerate the flow of gas by giving an excess of pressure. There can be very little doubt that much of the grumbling as to the great increase of gas registered in houses is due to this excessive pressure. The burners usually employed further augment the pressure at the point of ignition, with the result that the flame becomes thin and not very luminous. These effects lead to complaints as to the poor quality of the light and inadequacy of gas—complaints which have been met by the Commissioners, as if they really indicated want of gas, by further increase of pressure, with the information that the house-pipes are too small. My experiments have led me to believe that, in very many cases, the fault lies, first, in the excessive pressure; and, secondly, in the want of proper burners, so regulated as to neutralize the effect of pressure. In this belief I have made a series of experiments with several burners, under various pressures. I am aware that much work has already been done on this subject, and especially by the late Dr. Wallace, of Glasgow,* and by a Committee of the British Association consisting of Dr. Wallace, Professor Dittmar, and Messrs. Wills and Pattinson,† and by Dr. Stevenson Macadam. My experiments, however, have the advantage of having been carried out with various burners made with improvements introduced since the above-mentioned tests were made.

The fact that the pressure at which gas issues from the tip of the burner should be as low as possible has been recognized by all the best makers of burners, and has been met by various devices intended to check the inflowing gas. This has been more or less accomplished by the introduction into the burners of small screens of cloth, by perforated discs, by slit plates, by double burners, &c. These may be illustrated by Bray's ordinary burners, and the "Special" and "Adjustable" burners. Some makers manufacture governor burners; and I have tested a series of these. Bray's No. 8 burner is made of brass, and choked with gauze. This yielded me, at 15-10ths pressure and 7·8 cubic feet consumption, a light equal to 35 standard candles, or for each 5 cubic feet of gas burned, 22·69-candle power; at 10-10ths, the consumption of gas fell to 6·5 cubic feet, with a total light equal to 30 candles, or to 23·07 candles per 5 cubic feet; while at 5-10ths, the consumption was 5 cubic feet, with a light of 25 candles. Bray's No. 8 "Special" burner differs from the ordinary burner in having a perforated choke disc inserted. This simple addition leads to a decrease of pressure and increase of light. The results were as follows:—

Pressure in Tenths.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Calculated Candle Power per 5 Cubic Feet.
15	5·2	29·00	28·03
10	4·3	24·50	28·37
5	3·1	18·25	29·42

To still further overcome excess of pressure, Messrs. Bray are now manufacturing an adjustable burner. This is composed of two distinct burners; the lower being of much smaller size than the upper. For example, the lower may be a No. 5, while the upper is a No. 8. The burners are more or less choked with cloth. By this means you burn the gas which passes a No. 5 at a No. 8 tip; thus very materially reducing the pressure at the point of ignition. As they are not fitted to governors, pressure tells somewhat on the consumption, although, when the results with each burner are calculated to the light obtained from each 5 cubic feet consumed, they do not vary so much as might have been expected. The results are as follows:—

Adjustable Burner.	Pressure in Tenths.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Calculated Candle Power per 5 Cubic Feet.
3/0	15	2·60	10·00	19·20
	10	2·10	8·80	20·95
	5	1·45	6·30	21·72
4/1	15	3·00	15·40	25·66
	10	2·65	13·70	25·84
	5	1·80	9·60	26·66
5/2	15	3·50	18·30	26·14
	10	2·80	16·00	28·57
	5	2·15	12·20	28·37
6/3	15	4·20	22·50	27·97
	10	3·50	18·50	26·42
	5	2·60	13·00	25·00
7/4	15	5·00	34·00	34·00
	10	3·85	26·50	34·41
	5	2·80	20·25	37·21
8/5	15	5·35	41·00	38·21
	10	4·60	34·00	36·95
	5	3·40	25·00	36·76

Taking the higher burner, we find that at 5-10ths pressure the results were—

Burner.	Cubic Feet.	Candle Power.	Light per 5 Cubic Feet.
Bray's Ordinary	5·0	25·00	25·00
" "Special"	3·1	18·25	29·42
" Adjustable	3·4	25·00	36·76

At the other pressures, the difference is still more marked. The consumptions of the "Special" and "Adjustable" burners are very similar; but the light given is 19 per cent. better by the latter than by the former.

This system of double burners is by no means new, as I have here a double batswing burner manufactured by Messrs. James Milne and Son, of Edinburgh, some fifty years ago. As you will notice, the lower burner has a much smaller slit than the upper. The efficiency of this burner is shown by Messrs. Milne's old regulator (fifty years old), as follows:—

Pressure in Tenths.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Calculated Candle Power per 5 Cubic Feet.
15	6·8	48·0	35·29
10	5·6	41·0	36·60
5	4·0	29·5	36·87

On comparing these figures with those obtained from Bray's 8/5 burner, it will be seen that, at 5-10ths pressure, the results stand for each 5 cubic feet of gas consumed at 36·87 candles for the Milne, and 36·87 candles for the Bray "Adjustable." When the pressure is increased beyond 10-10ths, the balance is in favour of Bray's burner. Messrs. Milne also made at one time, for the city of Edinburgh lamps, a special burner, consisting of two ordinary union-jets screwed together. The effect was similar to that of the "Adjustable;" but it had not the advantage of the choking. One point very distinctly brought out in the series of tests with Bray's "Adjustable" burners is the great loss of light occasioned by the use of small-sized burners.

A device which seems to check the upward current of gas, by throwing one jet of the union burner against the other, is the "Spong deflector." I tested a No. 8 Bray burner with and without this attachment; and the results were as follows: At 15-10ths pressure, calculated to 5 cubic feet consumption, without the deflector, 22·69 candles; with it, 34·37 candles. At 10-10ths, without the deflector, 23·07 candles; with it, 31·25 candles. At 5-10ths, without the deflector, 25 candles; with it, 28 candles. The luminous flame is greatly enlarged, and the blue portion decreased; but the flame is somewhat unsteady, and decidedly more yellow in colour, and nearer the smoking-point.

Passing on to consider the regulation of consumption, the author said this could only be obtained by a special governor fixed on the supply-pipe, and more or less close to the burner. Many burners were made with regulators attached, such as Sugg's "Christiania," Parkinson's regulator, and Peebles's governor burners. Of Parkinson's burner he had only been able to procure one size (3½ A); and the results obtained with it were not so satisfactory as he should have wished. Possibly his samples had not been specially regulated for high-quality gas; but they were purchased in Edinburgh. The results were as follows:—

Pressure in Tenths.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Calculated Candle Power per 5 Cubic Feet.
18	3·70	12·00	16·21
15	3·25	11·00	16·92
10	2·70	10·04	19·26
5	1·60	5·80	18·12

He had made exhaustive tests with Peebles's governor burners. The governor required 8-10ths pressure to put it into action; and therefore the results at 5-10ths had only to do with the actual burner, and not with the governor. The regularity of the consumption was most marked. These burners, however, did not seem to improve the illuminating value of the gas, as the Bray burners would appear to do. This might have to do with the regulation of the orifices and the angles at which they were drilled—points which Mr. Hislop had shown had a marked effect on the light produced.* The results with burners supplied by Mr. Peebles were:—

Burner.	Pressure in Tenths.	Gas Consumed. Cub. Ft.	Illuminating Power. Candles.	Calculated Candle Power per 5 Cub. Ft.
Rat-tail, 0·5 cubic foot	15	0·58	1·70	14·65
	10	0·58	1·70	14·65
	5	0·58	1·70	14·65
Union governor, No. 1	15	1·15	4·00	17·39
2/1	10	1·15	4·00	17·39
	5	1·00	3·42	17·10
Union, No. 4	17	2·80	14·00	25·00
6/4	15	2·80	14·25	25·43
	10	2·80	14·00	25·00
	5	2·00	9·50	23·75
Union, No. 2	15	2·22	10·50	23·64
	10	2·00	9·50	23·75
	5	1·82	8·00	21·97
Union, No. 6	15	3·90	22·00	28·21
	10	3·80	21·50	28·29
	5	3·50	20·00	28·57
Union, No. 8	15	4·70	26·00	27·66
	10	4·50	26·00	28·88
	5	3·50	20·00	28·88
Peebles' street lamp burner as used in Edinburgh	18	2·00	7·20	18·00
	15	2·10	7·60	18·09
	10	2·00	7·20	18·00
	5	1·70	6·60	19·41

The author went on to state that Mr. Peebles had placed at his disposal a set of governors, each passing exactly 5 feet of gas at 18-10ths pressure, and had fitted them with different tips. The results would, therefore, show the variation in illuminating power due to the extra pressure brought to bear by the tip itself.

* See JOURNAL, Vol. XXIII., p. 583.
† *Ibid.*, Vol. XXXII., p. 423; also Vol. XXXVI., p. 376.

* See JOURNAL, Vol. LVIII., p. 164; also Vol. LII., p. 205.

The results were instructive, and proved that 5 cubic feet of gas burned from a No. 4 tip would only give 18-candle power, while from a No. 8 tip they obtained from the same quantity of gas, 27-candle power. The following were the results:—

	Pressure in Tenths.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Candle Power Calculated per 5 Cub. Ft.
No. 8 regulator, with No. 4 tip	18	5·00	18·0	18·00
	15	4·80	18·0	18·75
	10	3·40	12·0	17·65
	5	2·50	9·0	18·00
No. 8 regulator, with No. 5 tip	18	5·00	20·0	20·00
	15	4·90	18·5	18·87
	10	3·85	17·0	22·08
	5	2·85	12·0	21·05
No. 8 regulator, with No. 6 tip	18	5·00	26·0	26·00
	15	4·50	23·0	25·55
	10	4·00	19·0	26·25
	5	2·90	12·0	21·51
No. 8 regulator, with No. 8 tip	18	5·00	27·0	27·00
	15	5·00	27·0	27·00
	10	4·60	27·0	29·34
	5	3·50	21·0	30·00

Mr. Macadam said he had been to Peebles, and had tested the gas produced by Mr. Young's plant for enriching splint-coal gas with oil gas, and the results were as follows:—

Burner.	Gas Consumed. Cubic Feet.	Illuminating Power. Candles.	Illuminating Power per 5 Cubic Feet.	Illuminating Power per Cubic Foot.
Bray's "Special," No. 7	5·00	26·50	26·50	5·30
Bray's No. 3	3·20	9·00	14·06	2·81
Bray's No. 000	2·30	4·80	10·43	2·08
Splint-Coal Gas of 18-Candle Power.				
Bray's "Special," No. 7	5·00	5·00	18·00	3·60
Bray's No. 3	3·10	5·00	8·06	1·61
Bray's No. 000	1·90	1·50	3·94	0·788
Oil Gas of 96·35-Candle Power.				
Bray's "Special," No. 7	Smoked			
Bray's No. 3	2·63	31·00	58·93	11·786
Bray's No. 000	1·60	15·20	47·50	9·50
Milne's No. 2	1·95	23·00	58·97	11·79

The author said he looked upon Mr. Young's process as the best he had yet seen. He had inspected most of the apparatus used in making oil gas; but Mr. Young's gave a more regular output, and at the same time produced a very much higher class of gas than any other. It would appear that the only profitable way of using this gas was by admixture with a poorer quality of coal gas. His the author's experiments showed that, burned by itself, the highest illuminating power he could obtain from oil gas was about 59 candles. At Peebles, during January, there were manufactured 1,471,000 cubic feet of gas, of which 223,400 cubic feet was oil gas. The total illuminating power which should be obtained from the splint-coal gas was 4,383,360 candles; while the total was really 9,267,300 candles—leaving 4,883,960 candles from the oil gas. If they calculated these to the value of 5 cubic feet, the lowest value they could possibly put upon the oil gas was, not 59, but 96·35 candles. They had now been manufacturing oil gas at Peebles for more than three months, and sending it out for the supply of the town. He was always a little sceptical as to new forms of apparatus; but he was very much pleased with Mr. Young's plant, and he was perfectly satisfied, from what he had seen, that the system which Mr. Young had introduced would give very much better results than anything he had yet investigated. One great advantage of the process was that it thoroughly washed the gas, so that there could be no condensation in the pipes; and, further, that there were no bye-products. As a matter of fact, he produced a coke which, although he was aware, from letters which had appeared in the *Glasgow Herald*, people said would not burn, he had had burned in his own house. There was no difficulty in lighting it; and it gave out a great heat.

At the close of the paper, there was a discussion, in which Mr. D. Bruce Peebles, Mr. D. Macfie, Mr. D. Vass (Manager of the Portobello Gas-Works), and others took part.

Metropolitan Gas Company of Melbourne.—At the last half-yearly general meeting of this Company, a dividend at the rate of 17 per cent. per annum was declared, and a balance of £1676 was carried forward. Business in the city is, however, very dull; something like 10,000 houses being empty.

Systems of Car Lighting.—Those who wish to know how railway trains are lighted in the United States may be directed to a little book dealing with the subject, and issued by the *Engineering News* Publishing Company of New York. A good deal appears to be done by carburetted air, employed according to different systems. Most of the American railway trains, however, are lit by heavy petroleum oils; the vegetable oils which make darkness visible to the British railway passenger being despised and rejected across the Atlantic. The Pintsch system of oil-gas lighting seems to be making some headway in America; but the outfit is probably too costly for any but the wealthiest companies. There is not much done by way of electric lighting for railway trains, although there is something on this head in the book, which is not wholly devoid of padding. Most of the matter, it should be stated, has already appeared in the columns of the *Engineering News*; but the reprint is very convenient in form.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Testing for Sulphuretted Hydrogen.

SIR,—I can understand and sympathize with, though I have not experienced, the anxiety of working under penalties. I wish a better system could be introduced. Some twelve years ago, I thought I had succeeded in devising such a system, and submitted my scheme to the Board of Trade, who sent it on to Mr. Livesey. Now, he has told me, he thinks better of it; but he reported against it at the time. The scheme, which proposed an extension of the sliding scale to the quality of gas, may not have been practicable; but Mr. Livesey, knowing the pains I took in the matter, should not now represent me as an unsympathetic, because ignorant, supporter of the existing system.

I think that in the experiment Mr. Livesey describes—in which he passed a cubic foot of sulphuretted hydrogen into a 10-feet holder—the water and oil would be so fouled, and would give off the sulphuretted hydrogen they had absorbed so slowly and continuously, that even more than eight fillings with gas or air might well have been needed before the issuing gas ceased to act on lead paper.

It is fair to offer Mr. Livesey in turn the opportunity of criticising the method by which I have sought to obtain an answer to the same question.

Some thin glass tube, about ½ inch in diameter, was drawn out at intervals of a few inches to the size of quill tubing, and divided in the middle of each narrow portion. The capacity of each piece was taken, and marked upon it. All were again united with little bits of india-rubber tubing. Sulphuretted hydrogen was passed through till the air was completely expelled; and each piece was then sealed off by means of a small flame. A large stoppered bottle was chosen, whose capacity was a hundred times that of one of the tubes; and this was filled with coal gas which had gone through lime. The tube was passed up into the bottle; the stopper replaced; and the tube broken by shaking the bottle. The mixture thus made contained 1 per cent. of sulphuretted hydrogen.

A 10 c.c. pipette, whose stem extended some distance above the graduation mark, was charged through this length of stem with damp granules of oxide of iron; and on the end of the stem was fixed an india-rubber ball of about 30 c.c. capacity. The ball having been squeezed flat, the pipette was passed up into the 1 per cent. foul gas, and filled with this gas by allowing the ball gradually to expand. As the pipette was withdrawn, its point was closed by the finger; and it was at once transferred to an inverted litre flask, which had been filled with clean coal gas. By squeezing the ball, the contents of the pipette were driven into the flask. It will be understood that the gas which had entered the ball served to drive the foul gas out of the pipette—being itself made clean by twice passing slowly through several inches of oxide of iron. The mixture thus made contained one volume of sulphuretted hydrogen in 10,000.

For testing the gas, some lead paper was prepared in the manner described in the "Notification" of the Gas Referees. Mr. Livesey quotes a gas examiner as contending that lead paper cannot be so prepared in a London atmosphere; and he adds: "This is an apt illustration of the absurdity of the testing arrangements." Sometimes things are contended which are not true; but, if this contention is true, it illustrates a still graver fact—that the atmosphere of London contains about one part in 100,000 of sulphuretted hydrogen. Such a state of the atmosphere would cause universal discoloration of lead paint, and should render gas companies quite safe from prosecution on this ground.

Small squares of this lead paper, about ½-inch in the side, were fastened on to strips of writing paper, one of which was placed in the flask containing the gas to be tested. With gas containing one part in 10,000 of sulphuretted hydrogen, the small square of paper became dark brown in half a minute. Of this gas 10 c.c. were similarly transferred into another litre flask, and 50 c.c. into a half-litre flask—both filled with clean gas. The two mixtures thus made contained respectively one part of sulphuretted hydrogen in 100,000, and one in 1,000,000. Both were tested like the previous sample; the test-paper being left in the flasks for 24 hours, and the flasks placed in the dark. At the end of this time, the gas containing one part of sulphuretted hydrogen in 100,000 had tinged the paper (especially at the edges) of a faint brown colour; but the little square of lead paper, in the gas which contained only one part of sulphuretted hydrogen in 1,000,000, was as white as the writing paper to which it was fastened.

Oxford, March 11, 1893. A. VERNON HARCOURT.

Air v. Oxygen for Gas Purification.

SIR,—I have never stated that the admixture of air with gas does not reduce the illuminating power of the latter. But what I have stated, and adhere to, is that if air in the small quantities necessary is passed into lime purifiers in the proper way, its oxygen is as efficacious as if its nitrogen had been separated from it, which is all the so-called oxygen process consists of. Also that the nitrogen which passes forward into the purified gas acts at the most as a diluent. Mr. Humphreys, indeed, goes a step farther, and suggests that it may even be converted into cyanogen compounds, and as such be retained in the purifiers.

As regards Mr. Hicks' statement that the addition of ½ per cent. of oxygen raised 14-candle gas to 16-candles, I would suggest that a paper by him on "Enriching Coal Gas by Means of Oxygen instead of by Hydrocarbons," would be of great interest, as showing how much yet remains to be learned in the direction of enriching as well as of purification.

Vauxhall, S.E., March 13, 1893. C. C. CARPENTER.

The Investment of Reserve Funds.

SIR,—Your correspondent, "Factotum," is complicating this question, and is introducing matters entirely foreign to the points originally raised. He is quite right in theory regarding the mode in which a reserve fund should be treated in a company's books; and his double-entry suggestions are admirable. But, in practice, his idea of revaluing

the reserve fund each time a balance-sheet is made is impossible, and opposed to the spirit with which it was originated.

A reserve fund, defined for certain purposes, should be invested in Consols or some other accepted security; and the cash so invested is thus finally disposed of. Variations in market value should not affect it in any way; and I doubt whether official auditors would sanction further outlay—supposing means are at hand to do it with—should values have decreased. Legitimate outgoings from the fund ought to be repaid, and reinvested as quickly as circumstances will permit; but the cash (and not stock) is the amount to be dealt with.

A reserve fund really stands in the same position as trust money invested by trustees. The cash is given to them for a specific purpose; and after investment there are no means from which the fund can be altered or equalized in case of loss, nor is there any power to use the profit if one arises.

Invest reserve funds in Consols or other Government securities, after which let the *corpus* take care of itself; and the dividends can be treated in accordance with the requirements for which the fund was created.

March 10, 1893. GAS ACCOUNTANT OF THIRTY YEARS' STANDING.

The Velocity of Gas through Purifiers.

SIR,—Under the above heading, you gave in a "Note" in the JOURNAL for the 28th ult., an account of a mode, described in the *Journal für Gasbeleuchtung*, by Herr Zobel, of reducing the speed of the gas through purifiers by adopting two inlets—one at the bottom, the other at the top of the purifier—the purified gas entering the outlet at the middle. I beg to state that, at the meeting of The Gas Institute in 1889, I read a paper, with drawings, which appeared in that year's Transactions of the Institute, in which I proposed to purify four times the gas dealt with by ordinary purifiers of the same area. I showed purifiers over 20 feet deep, with one inlet-pipe standing vertically the whole height of the purifier, and connected by four valves—one at the bottom, and one at the top of the purifier; one of the remaining two being connected about 5 feet above the bottom, the other about 5 feet below the top—the gas meeting in the middle at one outlet. I proposed, in working the purifier, to open the lower and upper valve; and, when the upper and lower strata of material became foul, to open the other two valves.

March 8, 1893. GEORGE ANDERSON.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Opposition withdrawn: Bilston Commissioners Water Bill, Stockton-on-Tees Corporation Gas Bill, Todmorden Local Board Gas Purchases Bill, Wolverhampton Gas Bill.

Bills reported, with amendments: Accrington Gas and Water Bill, Dublin Corporation Bill, Rathmines and Rathgar Water and Improvement Bill, Sheffield Corporation Water Bill, Stockton-on-Tees Corporation Gas Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read a second time and committed: South Staffordshire Water Bill.

Bills referred to a Select Committee, consisting of Mr. Roby (Chairman), Sir J. Kitson, Sir G. Chesney, and Mr. Mildmay, to meet on Tuesday, March 14: Barry and Cadoxton Local Board Bill, Brighton and Hove Gas Bill, Brighton Electric Lighting Bill, Goole and District Gas and Water Bill.

A petition against the East London Water Bill was presented from consumers in the district supplied by the Company.

The Gas Signal-Light on the Clock Tower at Westminster.—In the House of Commons last Saturday, Mr. S. Herbert asked the First Commissioner of Works whether his attention had been called to the column of electric light which is flashed from a theatre in Shaftesbury Avenue; and whether he would consider the desirability of placing a similar light on the Clock Tower of the Houses of Parliament, in the place of the "inefficient gas light" now in use there. In reply, Mr. Shaw-Lefevre said the new gas signal-light recently placed at the top of the tower was at present incomplete, and could not be perfected till the Easter recess. The desirability of substituting a flash electric light had not, so far, been considered; and the propriety of making such a change was, he thought, very doubtful.

The Electric Lighting Scheme for Kingston-on-Thames.—On the 2nd inst., the Kingston-on-Thames Town Council had before them a long report by the Sub-Electric Lighting Committee on the various tenders which had been submitted for carrying out the electric lighting scheme for the borough. The specifications, prepared by Mr. W. H. Preece, provided for generating plant capable of lighting simultaneously 5000 35-watt lamps and 35 5000-watt arc lamps, together with the necessary mains, arc lamps, posts, and accessories. Twenty-four firms sent in tenders for the whole or various portions of the work. The tender recommended for acceptance was that of Messrs. Siemens Bros. and Co., Limited, which amounted, in the first instance, to £10,019 for the generating machinery and £7597 for the distributing plant. Considerable modifications, however, were subsequently made by the Committee, which reduced the total amount of the tender to about £11,800. The buildings, foundations, and chimney for the central station are to be erected by the Corporation; and the expenditure for these, together with Messrs. Siemens's modified tender, will easily come within the authorized capital outlay of £16,000. The recommendation was agreed to, with only two dissentients, who desired that the matter should be deferred till the next meeting, in order to give the ratepayers an opportunity of expressing their opinion upon it.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, March 6.

(*Before Lord Justice* A. L. SMITH.)

Chapman v. South Metropolitan Gas Company.

The following is the text of his Lordship's judgment in the above case, the result of which was briefly noticed last week:—

Lord Justice SMITH: The plaintiff, Mrs. Chapman, is lessee for a long term of years, under a lease bearing date 1878, of part of a building estate consisting of 28 acres, covered by some 600 houses lying contiguous to the defendants' gas-works at South Bermondsey; and she, in conjunction with two of her tenants, brings this action to restrain the defendants from carrying on their works so as to cause a nuisance to her tenants and an injury to her premises, and also for damages alleged to have been sustained. The plaintiff's allegations against the defendants are that, from and since the month of November, 1891, when they set up the manufacture of sulphate of ammonia upon their premises, and built a sulphate-house for the purpose, her houses have been physically injured by reason of the paint thereon (which was principally of grained oak and bronze green colour) having been turned, by the fumes from the defendants' works, a dirty grey colour, and otherwise defaced; that the articles of brass lacquer and gilt belonging to her tenants have become corroded and spoilt; and that a sickening and nauseous smell has at times pervaded her premises, by reason of the defendants' works. I may premise by saying that it has been clearly established that the sulphur which is contained in sulphuretted hydrogen is the chemical which has caused the damage to the paint and articles within the houses, and that about this there can be no possible doubt; and, indeed, as to this there is no real dispute. A body of evidence was called by the plaintiff to establish these allegations. By way of example, I may refer to the evidence of Uden, the undertaker, of George Dench, tenant of 2, Varcoe Road, of John Stallabrass, of 65, Credon Road, of Sarah Doughty, of 114, Verney Road, of Mrs. Thresher, of 116, Verney Road, and of John Cork, the meat salesman, of 72, Credon Road, to show what happened to them and the plaintiff's property after November, 1891. If these and the other witnesses called by the plaintiff needed corroboration, it will be found in the evidence given by the defendants' witnesses—namely, Reuben Kibby, Thomas Bristowe, Jennings, and Glendenning. After 17 witnesses had been examined for the plaintiff in support of these allegations, I intervened, and stated that, if the plaintiff had been unable to establish this part of her case by the evidence then adduced, I was certain she could not do so by doubling their number. A great effort was made, by way of cross-examination of the plaintiff's witnesses, to show that they all were in error when they asserted that the subject-matters of complaint first arose in and about November, 1891; and it was suggested that what was complained of since that date was only that which had existed prior thereto, and was just that which ever accompanied the manufacture of gas in a large way, as carried on by the defendants. That there were prior to November, 1891, at times, smells and also smearings of paint upon the plaintiff's property, by reason of sulphuretted hydrogen, I have no doubt, though in many instances they appear to me to have been of such a character that the tenants themselves did not notice the smearings, though others skilled in paintwork on stone or woodwork would have done so. The evidence of the plaintiff, if accurate, clearly demonstrated that, from November, 1891, downwards, matters relating to the plaintiff's estate underwent a great change; and it is clear that at this time complaints began to be made of what was then going on upon the estate. Thus, on the 22nd of January, 1892. Mr. Alfred W. Chapman, on behalf of the plaintiff, wrote to the defendants as follows:—

Dear Sir,—The process by which you are now making your gas is causing all the paintwork on the houses on this estate to turn a bluish grey. I should be pleased if you would make an appointment to view the property, in order that this nuisance may be stopped. We shall have to come upon your Company for damages; and if I do not receive an undertaking to stop it from you in the course of Thursday next, the 18th inst., I shall instruct the Solicitor to the estate to take proceedings to stop it.

Mr. Frank Livesey, in cross-examination, stated that the contents of this letter were true; and he said that when, shortly after its receipt, he went to see the premises, he found them badly discoloured. Again, on the 26th of January, 1893, Mr. Aldous, who was tenant of 70, Credon Road, wrote thus to the defendants—

Dear Sir,—I beg to inform you that, on account of the dreadful smoke made by the gas-works, and having a few months ago my shop repainted, I shall claim the amount required to have it done again. I have lived here over six years, and it is only lately that the smoke nuisance has commenced; and I hold the Company responsible for the damage done to my premises. Your immediate attention will oblige.

It is obvious from this letter that, when the gentleman mentions "smoke," he is alluding to the steam. On the 27th of January, Mr. Wellby wrote again to the Chairman of the Company from the Estates Office, 241, Rotherhithe New Road—

Dear Sir,—I desire to call your attention to the damage done to this estate by the fumes from the chemical works lately started at your works. The damage already done to this estate is very great, and becoming more serious daily, as many tenants have expressed themselves in strong terms, and say they cannot live here unless a stop is put to it. The fumes is (*sic*) fast destroying all paintwork, and even the paper on the walls. Trusting you will give this your kind attention, I remain, respectfully,

ALF. WELLBY.

It was proved—and to this there was no contradiction—that prior to November, 1891, the plaintiff's tenants had lived contented and uncomplaining lives, invaded by no more smells or sulphuretted hydrogen than that which ordinarily emanated from large gas-works. Why these complaints should first commence about this time, as they did, unless something was happening which had not happened before, I do not understand, and no suggestion has been put forward to account for them. There is not, upon the evidence, a trace of any complaint

made prior to November, 1891; and Mr. Frank Livesey admitted to Sir Henry James that, until the receipt of the letter of the 22nd of January, 1892, he had not heard of anyone complaining of what the defendants were doing. These 17 witnesses one and all stated (with the exception of Edward George Head, who obviously made the mistake of a year) that it was not till after November, 1891, that they began to notice and experience that which they subsequently underwent. Many of the damaged articles of brass lacquer and gilt were produced in Court. I may specially mention a pair of curtain-chains, once of brass lacquer, produced by Mrs. Mole, as very significant; also a family Bible, with gilt edges and brass clasps, produced by Mrs. White, and the metal picture-frames, which showed the general destruction which was taking place in these articles of brass lacquer and gilt. I should point out that it was sworn that the whole of the damage to the brass lacquer and gilt articles occurred subsequently to November, 1891. It is remarkable that the defendants did not produce a single witness to state that they had ever seen like damage before that date, either upon the plaintiff's premises or in their neighbourhood; and, indeed, those who were asked stated that they had not. Mr. Jelf, in his able opening speech, in which he clearly and succinctly laid before me every point which he took on behalf of his clients, attacked this body of evidence, and asked me to discard it, and find that it was not to be relied upon; and he stated that it was marshalled by a solicitor's clerk who was the son of the plaintiff's Solicitor. He said that the witnesses were all wrong when they asserted that it was after November, 1891, that the injuries complained of first came upon them, as he should conclusively show, and that, in reality, what they had experienced after that date was only what they had been experiencing before, and that they fixed upon the date of November, 1891, because they had seen the new sulphate-house being built by the defendants, and brought into play on the 3rd of November, 1891. I could not, in the state of mind I was left in after hearing this evidence, dismiss it as asked, for I felt that at the least it required to be answered. The first witness the defendants called was Mr. George Livesey the well-known Chairman of the defendant Company. This gentleman had been in Court, and had heard the evidence given by the plaintiff's witnesses as to what they had stated had occurred to them after November, 1891; and he was asked by his Counsel—Mr. Swinfen Eady—the following question:—

(Q.) Within the last few years has there been any increase in discoloration?—(A.) It seems to me to have been always the same; but I do not wish to doubt the evidence of those witnesses who say about December, 1891, they did notice an increase. My explanation is that there was no alteration in our works, and no increased emission of sulphuretted hydrogen whatever; but the atmospheric conditions at the time were, in my experience of over forty years, perfectly exceptional.

Mr. George Livesey here alluded to a great fog which lasted from the 19th to the 24th of December, 1891. That this is an important confession and avoidance by the man who, of all others, should know the effects produced by his own gas-works, cannot be gainsaid. He confesses the great point which the plaintiffs for some three days had been struggling to establish—namely, that, from some cause or other (which they asserted to be sulphuretted hydrogen), there had set in upon the estate, about the months of November and December, 1891, and continued thereafter, that which caused the nuisance complained of, and which had not existed before. Mr. George Livesey had heard this evidence, the same as I had; and I am not surprised at his saying that he did not wish to doubt the evidence of those witnesses who stated that about December, 1891, they noticed the increase to which they had deposed. As regards the avoidance—namely, the five-day fog between the 19th and 24th of December, 1891—I will say a word presently. Mr. George Livesey also admitted, in cross-examination, that he had "no doubt that the principal discoloration of the paint came from the gas-works." Notwithstanding this untoward start, the defendants' case proceeded at great length—36 witnesses in all being examined—till, to adopt the language of Sir Henry James when he rose to reply, "at length it had become an undefended case." Dr. Attfield had stated that he had never seen anything like what he saw on the plaintiff's estate in any part of London, except within a few yards of a retort-house and purifiers. Mr. Harland, also called by the plaintiff, said he had never seen anywhere anything approaching the damage that had been done to this particular property. And what said the witnesses for the defendants? Dr. Odling said that "the amount of injury in this case is greater than one is accustomed to see round gas-works now-a-days." Mr. Woodall, civil engineer, said: "I don't think I have ever seen examples so bad as the corner of Varcoe Road; I don't think I have ever seen a place so bad as Credon Road anywhere," though he went on to say that "the plaintiff's estate has been deliberately prepared to show the worst possible case." He is the only witness who made the suggestion; and I do not adopt it. Last, but by no means the least, Dr. Stevenson stated that "the back door produced"—that means the back door which was produced in Court—"was quite an abnormal state of things. I say," said he, "that practically the damage to the whole of the area of the plaintiff's estate which I have described came from the gas-works." Mr. Dinwiddy, one of the defendants' Surveyors, stated that he had seen, backing on the canal, ten or a dozen doors as bad as the door described by Dr. Stevenson as abnormal. I must here point out that, throughout the whole of the large body of evidence called by the defendants, there is not a single witness who, when asked in cross-examination whether he had ever seen, prior to November, 1891, a single door in any street upon any property in a condition similar to either of the two doors which were produced, who did not say that he had not, with the exception of Mr. Barker, who said that he had seen a door as bad in Sturgeon Road. The defendants' witnesses did prove—what I have not the slightest doubt is the case—that, in the neighbourhood of the defendants' and of other gas-works, where considerable quantities of sulphuretted hydrogen are daily generated, lead paint is constantly splashed with the dirty grey colour to a greater or less degree; and that such splashes existed prior to November, 1891, upon the painted stone and woodwork upon parts of the plaintiff's estate, I think is proved. I have no doubt, if it had been looked for, and especially by persons conversant with the trade of carpentering or painting, it would have been noticed; but that it existed prior to November, 1891, to anything like the marked and obvious degree which it has since assumed, these witnesses did not prove, nor did they prove that what had occurred prior to November, 1891, had simply continued after that date. John Beeby, a carpenter, called by the defendants, who had worked upon the property down to about the year 1889, in my judgment hit the mark when he said: "I am sure I don't know if the injury was then such that any tenant might see it. I, being a carpenter, saw it. I don't know if the tenants saw it." I made it my business to go down and see the premises after I had taken the bulk of the evidence on both sides; and the view in every way confirmed the evidence given by the plaintiff's witnesses as to the nature and character of the injury to the paint. The nearer one approached the south-west corner of the estate, with remarkable intervals where the property appeared practically to have escaped, the more apparent and universal became the dirty grey colour, especially upon the woodwork of the window-frames; till at last, in Credon Road and Varcoe Road, for considerable distances the woodwork became almost wholly of the dirty grey colour, and largely in excess of what I could find elsewhere in the neighbourhood. I there saw window-frame after window-frame as bad as the sash which was cut out of No. 6, Varcoe Road, and produced in Court. I may add that the part of Verney Road off the estate, and which was much nearer to the purifiers than the south-west portion of the estate, exhibited nothing like the amount of dirty grey colour as this part of the plaintiff's property did, which was more contiguous to the sulphate-house, although this portion of Verney Road was in a much worse condition, as regards painting and repairs, than the plaintiff's estate. I am aware it was stated that the plaintiff's property had become worse since the autumn and winter of 1892-3 than it was during the winter of 1891-2; and I think that is very probable. The plaintiff's estate did appear to me to be, as the defendants' witnesses stated, in many places in need of repainting, irrespective of the dirty grey colour existing upon the houses. In my judgment, the plaintiff has established her case as regards the nature and extent of the injuries suffered to the paint and articles of brass lacquer and gilt over portions of her estate; that those injuries have been caused by the sulphur contained in the sulphuretted hydrogen brought upon her estate; and that the injury experienced since the month of November, 1891, is far in excess of anything experienced prior to that day. It is also proved that the sulphuretted hydrogen has caused many of the smells which the tenants have experienced and complained of since that date; and also that what the plaintiff has suffered upon part of her estate since November, 1891, is a nuisance. I now come to the question whether the plaintiff has established that these injuries were occasioned by acts of the defendants for which they are liable. Divers points were taken on their behalf: First, that they did not cause the injuries complained of by anything they did at their works, and that the alleged injuries did not exist in fact; secondly, that what was complained of was only that which by statute they were entitled to do; thirdly, that what was complained of was what they had a prescriptive right to do by twenty years' user; fourthly, that the discoloration of the plaintiff's paint, the smells, and the damage to the brass lacquer and gilt articles were brought about by sulphuretted hydrogen from works other than defendants'; fifthly, that the same was brought about by the sulphuretted hydrogen which exists everywhere, irrespective of gas-works; sixthly, if not, then that the damage complained of was augmented by these two last supplies of sulphuretted hydrogen; seventhly, that the low and damp situation of the plaintiff's estate renders the effect of sulphuretted hydrogen more active than it otherwise would be, and hence the injuries; eighthly, that the fog of the 19th to the 24th of December, 1891, caused the damage; and, ninthly, that the want of paint upon the plaintiff's premises was the cause of the mischief. I may here interpolate that this judgment is much longer than I intended it to be; but so many points were taken that I really could not write it shorter without leaving out some of those points. It was also argued that no action could be maintained by the plaintiff for the escape of sulphuretted hydrogen from the defendants' works, for what did escape was only that which necessarily escaped in the necessary prosecution by them of their trade as producers of gas; and that, both under statutes and prescription, they were entitled to do what they did. In other words, they asserted that what I may call their output of sulphuretted hydrogen, which escaped in the years 1891 and 1892, was not in excess of that which they had been outputting as of right for the last twenty years and more; and they further sought to show that it was less. I do not think they established these last points. They also said that, even if the continued effect of their steam and sulphuretted hydrogen caused the nuisance complained of, it was not actionable, for they said that the output of steam was lawful, and that the output of sulphuretted hydrogen was lawful; and, therefore, that both combined were lawful. I stated at the time that, in my judgment, such a proposition was untenable; and I repeat it now. Considering the proved facts of the case, it is wholly unnecessary for me to consider some of the above-mentioned points. But I may say that it does seem to me that, had things been allowed to go on by the defendants as they had been going on prior to November, 1891, this action would certainly not have been brought; for, as before pointed out, no one had complained. The plaintiff's Counsel have expressly stated that prior to November, 1891, their clients had suffered no nuisance at the hands of the defendants, nor had they objected to what the defendants were doing. It appears, from the evidence of Mr. Frank Livesey, that the defendants have the following sources upon their premises from which sulphuretted hydrogen is produced and allowed to escape into the open air: First, and principally, upon every occasion upon which the defendants open and cleanse any of their 16 lime purifiers, and which occurs upon four, and sometimes upon five, days a week, a large quantity of sulphuretted hydrogen escapes into the open air; and, secondly, when coal is quenched, which takes place day and night, there is also an escape, but this is said to be small. There is, in addition to this, the sulphuretted hydrogen which is ever present on the defendants' premises in the same way as it is present on the premises of others. Dr. Attfield told me that sulphuretted hydrogen was contributed to the air of London by every man, woman, and child in the ordinary course of Nature; also by every chimney, by stables, by leakages from drains, and numberless other

sources—gas-works and chemical laboratories included. I have no doubt this is correct. In all towns, even apart from gas-works, it appears that sulphuretted hydrogen does exist to some extent. An effort was made by the defendants, by means of coloured Ordnance surveys, to show its presence in marked quantities at different parts of London inside and outside the range of gas-works. Such places as Piccadilly, Grosvenor Square, Belgrave Square, Portman Square, and many others, were so coloured; and Mr. Barker, a witness for the defendants, told me that these places all suffered from the same cause as the plaintiff's property—viz., from sulphuretted hydrogen—though not to the same extent. I pass by these West-end instances, for to attempt to compare them with the plaintiff's estate is simply absurd and misleading; and I have seen both. I also went to Sturgeon Road, Old Surrey Gardens, which Mr. Baker stated was the worst place he knew of off the plaintiff's estate, and the place where he had seen a door similar to the doors in Court. That dirty grey patches of mould exist in the street upon the painted stucco work over the projecting bow windows is patent; but I cannot compare this street, for damage to paint, with the streets on the south-west of the plaintiff's property. I have little doubt, though I did not see it, that Ruby Street is discoloured more or less. The theories about what I may call the natural production of sulphuretted hydrogen as being the cause of the damage to the plaintiff's estate, or indeed in any substantial degree contributing to it, may, I think, be put aside; for, as before stated, Mr. George Livesey said he had no doubt that the principal discoloration of the plaintiff's paint came from the defendants' gas-works, and Dr. Stevenson stated that within a given area it was the gas-works that were the cause of the damage. The defendants, however, did not leave things as they were; for in 1891 they determined to convert into sulphate of ammonia, upon their own premises, their residual product of ammoniacal liquor, which theretofore they had sold to be converted elsewhere by others. Mr. Frank Livesey said they had unusually large stores of ammoniacal liquor upon the premises, and that they have converted it into sulphate to the money's worth of about £20,000 a year. For this purpose they erected the sulphate-house, which was set to work on the 3rd of November, 1891. The house is of large dimensions; and two sets of apparatus were set up therein for the purpose of this manufacture of sulphate of ammonia. It is the fact that ammoniacal liquor contains sulphuretted hydrogen in large quantities, which is given off when the liquor is exposed to the air. Mr. George Livesey thought that the tanks in which the ammoniacal liquor was stored by the defendants were ventilated; and, in his evidence, he stated that sulphuretted hydrogen would escape through those ventilators. But Mr. Frank Livesey stated that this was erroneous; and I take it to be so. In these tanks very large quantities of ammoniacal liquor are stored. Upon what I will call the top of the new sulphate-house, the defendants erected a tank into which they pumped the ammoniacal liquor from the tank below—Mr. George Livesey stating to me that this tank had the necessary ventilator at the top. But Mr. Frank Livesey said this was not so; and I again take it that he is correct. It appeared, however, from Mr. Frank Livesey's cross-examination, that this tank, though it had no ventilator, was made of iron, with a top made of deal boards tongued together, while its ends are fitted into wooden planks, and its sides rest upon planks to which it is fastened. This wooden top is 1¼ inches thick, and is tarred over to prevent the wood "warping," as Mr. Frank Livesey put it. It was stated by the defendants' witnesses that this top was air-tight. Mr. Frank Livesey said he knew that the ammoniacal liquor which went into this tank upon the sulphate-house was full of sulphuretted hydrogen; and knowing that the way in which this tank was constructed was dangerous, he had endeavoured, to the best of his ability, to make it perfectly tight. It is clear that, if this wooden top is not air-tight, sulphuretted hydrogen would be given off from the ammoniacal liquor in the tank into the open air, and would escape at a point near to the top of the shaft with the steam vapour issuing therefrom, to be hereafter mentioned. That this sulphate-house, which was first set to work on the 3rd of November, 1891, contained large quantities of sulphuretted hydrogen, is undoubted; for Mr. George Livesey told Sir Henry James that there was a very large quantity of sulphuretted hydrogen constantly flowing through the sulphate-house. When first this house was opened, there existed an open tank 30 feet long by 15 feet wide, on the ground alongside of the house, and from it large quantities of steam vapour evaporated from the surface of the boiling water in the tank. Mr. Frank Livesey told me that one day he became enveloped in the steam vapour given off this tank. He thereupon had it closed, and the shaft put up, as he considered it dangerous to his horses passing the tank; and I do not doubt that this was the reason for such being done. Mr. Frank Livesey also said that he believed there was some smell in that steam, but that it was not sulphuretted hydrogen; but he did not know what it was. This tank was covered over in the middle of January, 1892; and a shaft, 18 inches in diameter and 35 feet high, was erected to carry off the steam vapour from the tank. This steam vapour passed off continuously day and night in considerable volume, and sometimes continued upon Sundays; and when the wind was south-west, it certainly went to, and, in my judgment, passed into, over, and through a portion of the plaintiff's estate. Dr. Attfield stated: "There are very large volumes of steam coming from the shaft night and day." The tank and shaft are about 70 yards distant from the south-west corner of the plaintiff's estate. That the plaintiff and her advisers should, in these circumstances, have thought that the sulphuretted hydrogen, with which her estate was then being unquestionably badly affected, came from the new sulphate-house by means of this vapour or steam, was but natural. Efforts were made by them to detect how it was that the sulphuretted hydrogen passed out of the sulphate-house with the vapour; and their case appears to me to have been launched and continued, till after the cross-examination of Mr. Newton, upon the supposition that the delinquent sulphuretted hydrogen passed from the house in the steam. This, however, certainly has not been established, and was practically abandoned by Sir Henry James. Not only did the plaintiff not prove the fact as part of her case, but it was disproved to my satisfaction by the witnesses who were called by the defendants. In my judgment, no sulphuretted hydrogen passed up this shaft with the steam. The question still remains: Where did the sulphuretted hydrogen come from which inflicted the proved injury upon the plaintiff? In my judgment, it is not incumbent upon the plaintiff to prove the exact spot from which the sulphuretted hydrogen comes, or the exact manner in which it comes; but she must prove that it does, in fact, come from the defendants' works, and do the injury sued for. That is the issue she has to establish. It is obvious that, if she can prove the exact spot in the defendants' works that it comes from, and exactly how it comes, so much the better for her; but, as before stated, in my judgment, she can support her action without proving either the one or the other. Now for the suggestions by the defendants as to how the damage was done; I have already dealt with the theory of its being what I may call natural sulphuretted hydrogen. As regards its coming from other works, no case worthy of the name of a case has been made. In my judgment, the natural sulphuretted hydrogen does not appreciably augment the injury caused to the south-west corner of the plaintiff's estate. By this I mean that what slight discoloration natural sulphuretted hydrogen might make is absolutely swallowed up and obliterated by the quantity, virulence, and activity with which the sulphuretted hydrogen, since November, 1891, came from the defendants' works to the plaintiff's property. As regards the seventh suggestion, it appears to me that the plaintiff's estate was as low and damp before November, 1891, as since; and that this point avails nothing to the defendants. I now come to the case of the fog from the 19th to the 24th of December, 1891. As regards fogs, it is the fact that they carry with them sulphuretted hydrogen; and it is this sulphur which causes silver and plated articles to tarnish in a fog. The way a fog becomes impregnated with sulphur appears to be that it hinders the sulphuretted hydrogen which would otherwise pass away into the air from so passing; and thus the sulphuretted hydrogen is kept in the fog. That the five-day fog spoken to by Mr. George Livesey was an abnormal one is proved in this—that three days are usually the extent of a long fog, whereas upon this occasion it lasted five. It appears also to have been dense. The defendants' witnesses stated that, when a fog passes off, the sulphuretted hydrogen does the same; and so damage is no longer done by it. This theory of the fog having caused the damage upon the plaintiff's estate was first suggested, so far as I can find, by Mr. George Livesey, when examined in chief under the circumstances before mentioned. Not a question had been put to a single witness of the plaintiff as to whether the damage came on contemporaneously with this great fog; nor do I find that the defendant Company set up this defence when the complaints were made to them in January, 1892. It does not appear to me, upon re-reading the evidence of the plaintiff's witnesses, that their damages all came on at the same time, nor during or at the end of the five days in question. Moreover, there had been plenty of three-day, though not of five-day, fogs before November, 1891, and the present injuries not brought about. In my judgment, the fog theory does not establish that it was the cause of the plaintiff's injuries. That it may have done some damage to the plaintiff's property is, I think, probable; but Dr. Stevenson, among other witnesses for the defendants, has not adopted this suggestion of the fog having done the damage upon the estate. I now come to the point taken, that the injuries were occasioned by reason of the plaintiff's premises not being efficiently painted. I should point out that this does not apply to the smells experienced since November, 1891, above alluded to. The plaintiff's premises appear to have been painted at all times; and a recently painted house, such as Uden's, has been the worst affected. I do not doubt that the older, and therefore the rougher, skin the paint gets, the more prone it is to be injured by sulphuretted hydrogen; but to say that the age of the paint upon the estate caused the damage which occurred, and which I have seen, is not, in my judgment, the fact, though, as before stated, I think the bulk of the plaintiff's estate under-painted. I at last arrive at the point as to where the sulphuretted hydrogen which did the mischief in fact came from, and how it passed on to the plaintiff's premises—in other words, whether the plaintiff's theory about this is correct. I will quote Dr. Attfield's own words—

(Q.) To what do you attribute the excessive and increased injury to the plaintiff's property?—(A.) I attribute it to the carriage of the sulphur in the general air of the works by the steam from the sulphate-house to the plaintiff's property. I must say that the steam may contain sulphuretted hydrogen. But, assuming the steam to be free itself of sulphuretted hydrogen at the end of the shaft, yet by the laws of Nature it will dissolve any sulphuretted hydrogen there may be in the air of the works through which it passes, and will carry sulphuretted hydrogen in a concentrated form to paintwork; for a given bulk of water will dissolve three times its bulk of sulphuretted hydrogen, and, when the water is in the form of steam, it is in the most fit condition to dissolve sulphuretted hydrogen. The wind will carry the steam and the sulphuretted hydrogen all together. If the steam was not there, the sulphuretted hydrogen would be carried by the wind. But without the steam, it would not be concentrated; and it would not condense on paint surfaces or others as it does when associated with steam. By combination I mean that, by virtue of the natural power of water, whether in vapour or not, to dissolve sulphuretted hydrogen, I say that it must thereby necessarily become concentrated. The effect of the concentration is to bring a greater amount of sulphuretted hydrogen to a given area of paint than would occur if no steam were present.

He also stated that there was an affinity between sulphuretted hydrogen and steam. In cross-examination, he said: "I say the sulphuretted hydrogen becomes more mischievous, intense, and concentrated by reason of the steam." Mr. Church and Mr. Harland gave evidence in corroboration of Dr. Attfield. Dr. Odling—an undoubted expert in gas—called by defendants, disputed Dr. Attfield's theory, and stated that ordinary steam, such as came out of the shaft in question, would not attract to it, or become the vehicle of, sulphuretted hydrogen from the atmosphere, either in a concentrated or unconcentrated shape; that steam, by a law of Nature, would not take up sulphuretted hydrogen as Dr. Attfield had stated; and that Dr. Attfield was entirely incorrect, as there was no such law. He, however, stated that the damper the atmosphere, the more active was sulphuretted hydrogen. In cross-examination, he admitted that, if steam came in contact with sulphuretted hydrogen upon lead paint, it would increase the dampness, and so far intensify its action; and that, if the sulphuretted hydrogen thus came to Uden's yard, it would have a greater action upon the paint than if it came without the cloud of steam. He still

adhered to it that, though Dr. Attfield was a gentleman of competency, he had made a mistake about the concentration, though he stated, if there were concentration, the effects stated by Dr. Attfield would be correct. Dr. Thomas Stevenson, so well known to many for years as the skilled adviser to the Home Office in matters of chemistry, gave this evidence on behalf of the defendants—

(Q.) Will you kindly, in your own way, tell my Lord whether you think the steam coming out as you saw it come out, itself uncharged with sulphuretted hydrogen, would aggravate any nuisance to the plaintiff, either from sulphuretted hydrogen in the air, or sulphuretted hydrogen from the gas-works?—(A.) It might, occasionally. I mean that steam, in the scientific sense itself, does not aggravate the action of sulphuretted hydrogen; but water (vesicular steam) does absorb sulphuretted hydrogen, and give it up again as the vesicular steam is again vaporized. The effect of such absorption and vaporization would be that, whenever the visible vesicular steam actually impinges upon a surface, such as a door, there would be some slight increase of effect, but that would only occur when the visible vesicular steam was carried to the door. I have never myself seen visible steam carried as far as these houses.

As regards this last, I cannot help thinking that Dr. Stevenson has made some mistake, for there is the positive evidence of Stammers, also of Mrs. Mole, of 24, Varcoe Road, who said: "It used to blind us at times; it was very thick at times." Also of Dr. Attfield and Mr. Church that the steam did, in fact, reach the plaintiff's premises, and that they had seen it there. Mr. George Livesey, in cross-examination, had said—

The steam might go as far as Uden's yard; and if sulphuretted hydrogen was in the steam, it would intensify the effects and injury of the sulphuretted hydrogen. I daresay the steam would carry as far as Uden's yard. The steam might have met with sulphuretted hydrogen in Uden's yard; and, if so, it would cause the sulphuretted hydrogen to affect the paint more than if there were no steam.

Dr. Stevenson added: "Steam does not pick up—that is, absorb—sulphuretted hydrogen." It seems to me that this evidence of Dr. Stevenson is far more corroborative of Dr. Attfield's testimony than of that of Dr. Odling. Sir Frederick Bramwell gave his valuable assistance to the defendants. He at once took up the position that he was not a chemist, and could not give any evidence upon that subject—a position which struck me as prudent, seeing the difficulties the defendants were in with their theories about sulphuretted hydrogen. Sir Frederick proved that unique care was taken by the defendants that no more sulphuretted hydrogen than was necessary should escape when the purifiers were opened; and he also proved that sulphuretted hydrogen ought not, with due care, to be given off by the process worked in the sulphate-house. He added: "I do not believe that it can." He also gave evidence as to the amount of vapour steam emanating from the shaft of the sulphate-house; and he said it could not be more than one-seventh of that which came out of an ordinary locomotive engine. He laid considerable stress, as had other of the defendants' witnesses upon this—that this vapour steam was not under pressure, and was what he designated as "reek," or as the vapour given off from a hot bath. Sir Frederick, however, together with the defendants' Counsel, had not been informed that there was, in addition to the shaft, a steam-jet upon the east side of the sulphate-house, issuing at about 8 feet from the ground-level under pressure night and day, and of which, if I had not happened to have gone down to take the view I did on the Saturday afternoon, neither I, Sir Frederick, nor the defendants' Counsel would ever have heard a word. I do not know if what Mr. Frank Livesey then said about the diameter of this pipe, or the capacity of the engine, be correct. He said he had forgotten about the steam, though question after question had been asked of the defendants' witnesses as to whether the steam issued under pressure or not; the point being that, as it did not, it was not so likely to do harm as if it did. What I do know is that I saw the amount of steam which was issuing from this pipe under pressure, and that it was undoubtedly considerable. For the Court to have been kept in ignorance of this for days, as it was, naturally shakes my confidence when I am told that no sulphuretted hydrogen ever did escape from that sulphate-house excepting upon two occasions when there were accidents, as spoken to by Mr. Frank Livesey. I may notice that the manager under whom this sulphate-house has been worked was not called; and I cannot think that this occurred through any anxiety of the defendants to save time. It is not incumbent upon me to find whether or not the plaintiff's theory be correct; but it seems to me to be highly probable. But be this as it may, I have not the slightest doubt, having heard this case for some nine days, that the injuries complained of by the plaintiff are caused by reason of sulphuretted hydrogen from the defendants' works being allowed to come, in such a manner and in such quantities, since November, 1891, as to cause not only personal discomfort to the tenants of the plaintiff's estate, but also an actual injury to the plaintiff's property to such an extent as to visibly diminish the value of that property, and the comfort and enjoyment of it. It cannot be doubted that this constitutes an actionable nuisance. (See *St. Helen's Smelting Company v. Jeffery*, 11 H.L., p. 640.) This the plaintiff has established by proof. The defendants, on the last day of the hearing, stated that they were willing to give an undertaking to condense the steam issuing from the sulphate-house; and they suggested that I should make an order to this effect, and not grant an injunction. But I must point out that if their case as to the steam, which they have persisted in, be correct, this would not abate the nuisance which I find to exist; and I should not be granting to all the plaintiffs that relief to which, in my judgment, they are entitled. I therefore grant an injunction, and in the form asked; prefacing it with the words: "The Judge being of opinion that the mode in which the defendants have carried on their works did not, prior to November, 1891, occasion any nuisance of which the plaintiffs were entitled to complain." The plaintiffs are entitled to an inquiry as to damages, which I will ask (by the consent of parties) Mr. Ridley to be so good as to make. I will see Mr. Ridley, and tell him over what area of the plaintiff's property he is to assess damages, and also how he is to deal with their measure. I allow the defendants now, if so advised, to offer to the plaintiff an amount for such damages, before going to Mr. Ridley. That is only to apply to the costs of the arbitration. The costs of the inquiry before Mr. Ridley I reserve. The plaintiff must have the costs of this action and of the motion for injunction.

[As already reported, his Lordship granted a stay of execution for three weeks, to allow time for consideration as to an appeal; remarking that it was a very important case. If notice of appeal is given, the stay is to continue until the appeal is heard. He refused an application by Sir H. James to allow costs on the higher scale.]

Thursday, March 9.

(*Before Mr. Justice* COLLINS.)

Hersey v. White and Others—The Supply of Gas in "Flats."

In this case Mr. George William Hersey, residing at Manor Mansions, Belsize Park Gardens, sued for damages and an injunction restraining the defendants from further interfering with the supply of gas to his flat. The defendants justified their action.

Mr. CRUMP, Q.C., and Mr. BROOKE LITTLE appeared for the plaintiff Mr. WILLIS, Q.C., and Mr. MACASKIE represented the defendants.

Mr. CRUMP, in opening the case, said that, although the amount involved was small, the point raised was one of some importance to occupiers of residential "flats" in London mansions. By a lease dated Oct. 14, 1890, and made between the plaintiff and the defendants, the latter let to the former, for 21 years, rooms forming a third-floor flat of No. 8, Manor Mansions, together with "all rights, easements, and appurtenances whatsoever to the said rooms belonging or appertaining." The lease also specified that the lessor would provide and maintain a proper supply of water, and pay "all existing and future taxes, rates, charges, assessments, and impositions whatsoever . . . charged in respect of the premises, as part of the mansion or otherwise," with the exception of the gas-rate to be charged for gas consumed on the premises. At the time of the granting of the lease to the plaintiff, and continuously up to the time of the acts complained of, gas was supplied to the plaintiff's flat by a single pipe running from the Company's mains. This passed through a large meter, which measured the whole of the gas consumed in No. 8, Manor Mansions. From the large meter, service-pipes carried the gas throughout the different flats in the mansion, including the plaintiff's, which was provided with a smaller meter at the entrance of the flat. This smaller meter was furnished by the defendants by an agreement independent of the lease. The agreement provided that, so long as the meter remained there, the plaintiff should pay to the defendants for its hire 2s. a quarter, and for the gas passing through it 3d. per 1000 cubic feet more than the defendants paid the Company. The plaintiff objected to pay this extra charge of 3d.; and on Feb. 17, 1892, the defendants disconnected the gas-pipes in his flat, thereby cutting off the supply. It was, however, subsequently restored on an application being made to a Judge in Chambers. Counsel submitted that, though the defendants appeared to think they could exercise the statutory powers conferred upon gas companies, they could not do so; and therefore he maintained that the plaintiff was entitled to an injunction, and also to damages for the inconvenience he had suffered.

Mr. WILLIS, on behalf of the defendants, argued that his clients had not interfered with any "right, easement, or appurtenance" to the premises. There was no agreement on the part of the defendants to supply the plaintiff with gas for any fixed period; and as the plaintiff refused to pay a reasonable charge for that which had been supplied him, the defendants were justified in objecting to supply him with any more—leaving him to make his own arrangements with the Gas Company. The defendants were responsible to the Company for all the gas supplied to the mansions, and the extra 3d. per 1000 cubic feet was charged to cover the services, expenses, and risk which they incurred by reason of their undertaking to supply their tenants with gas. He would remind the Court that none of the tenants were bound to take the gas.

Justice COLLINS, in giving judgment, said the case raised a nice point. He thought that the plaintiff was entitled to an injunction restraining the defendants from interfering with the supply of gas to the pipe which at the time of the demise was connected with the gas supply, and passed into the premises demised. It was true there was no express covenant to supply gas; but that did not detract from the obligation contained in the original grant. The parties obviously bargained on the footing that gas should come into the demised premises. The lessor had no right to cut off the supply of gas, even though the tenant had not paid him what he, the lessor, had paid for the gas. In that case the lessor had his proper right of action to sue the tenant for what he had paid on his behalf. There would be judgment for the plaintiff for 20s. nominal damages, and an injunction in the terms asked for, with costs on the higher scale.

Proposed Extensions at the Chorley Gas Works.—A Local Government Board Inquiry has lately been held at Chorley Town Hall by Major-General H. D. Crozier, C.E., regarding an application of the corporation for power to borrow £30,000, of which £20,000 is required for gas-works extensions. It was explained that owing to the increasing population and growth of the districts, more gas was required than the present plant and mains could supply. Mr. C. Elliott, Manager of the Leyland Gas Company, said he appeared to object to the Chorley Corporation supplying Clayton-le-Woods with gas. His Company, by their Act of 1863, had power to serve that township; and the reason their mains had not been extended there was because it would not pay. The Company wanted to protect their rights, and would be satisfied with a nominal payment per annum as an acknowledgment; they having the power to re-enter and acquire the mains of the Chorley Corporation at a valuation, when it was considered advisable. The Mayor of Chorley contended that, as the Company had done nothing in the way of supplying Clayton for 30 years, they ought to stand aside. The Inspector then proceeded to examine the details of the proposed works, which included a new gasholder to cost £10,000.

MISCELLANEOUS NEWS.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. FREDERIC LANE LINGING in the chair.

The SECRETARY (Mr. Magnus Ohren) read the notice convening the meeting; and the Directors' report and the accounts, of which an epitome appeared in last week's issue, were taken as read.

The CHAIRMAN moved the adoption of the report and accounts; and, in doing so, said the Directors met the shareholders that day under more favourable circumstances than they had been enabled to do for some time past, for they were, on this occasion, in a position to lay before them a statement of accounts which showed that they had realized a sum sufficient to meet the dividends upon the invested capital without calling upon their reserve fund, and also carry forward to the present half-year's accounts a small balance. In the six months ending Dec. 31, 1891, they had to draw upon the reserve fund rather heavily; but now he thought they might congratulate themselves in being able to state that they had arrived at a position which he might fairly call their normal position, and that had been, for a series of years, one of great prosperity. There had been several favourable circumstances during the past half year that had tended to place the Company in their present satisfactory position—such as the reduction in the price of coal, and the large increase in the quantity of gas sold. There had been one or two other small items, not of any magnitude in themselves, but in the aggregate he thought they tended to show that every attention had been paid, on the part of their Engineer (Mr. C. Gandon), in the works department. A substantial saving had been made in the coals; and he might state that the benefit would have been larger, but they brought over on June 30 last a considerable stock of coals which had been purchased in their troubles, or perhaps he should say during the strike of the miners in the Durham district. These coals having been carbonized during the half year under consideration, of course the revenue had been charged with them; so that, as he had before stated, had it not been so, they would have shown rather better results. With regard to the residual products (upon which all gas companies depended to a very large extent), he was sorry he had not much to say in favour of their position in that respect. This had arisen more particularly from tar. Tar was a commodity that was distilled, and produced certain results; and those results, as residuals, as a rule, were singularly valuable. But, from circumstances which really he could not explain, they had been in a most depressed state; and the consequence had been that, instead of realizing the usual amount for tar, the receipts were less by £1534 than in the corresponding period of 1891. As regarded their assets, they were in a very healthy state. The rental and the gas sold were increasing; and the plant (which was always kept in the highest state of preservation) was equal to their present wants—he might say perhaps *only* equal to their present wants; and there was no doubt the Directors would be compelled, in the course of the coming summer and autumn, to increase the plant to a certain extent. This had lately been under the consideration of the Board on more than one occasion, and would receive their future further attention. The shareholders would remember that he had at former meetings alluded to the Company's new large gasholder. It had been at work during the whole of the past winter, and had enabled them to supply the district in a most efficient manner; and, moreover, it had this great benefit, that it had placed in the hands of the Engineer an amount of storeage that would have been equal to any extraordinary demand that might have been made upon him. As to the accounts, he had already alluded to the item of coals, which had been their principal source of saving—there having been a decrease of £3143, compared with the half year ending December, 1891. There had also been a saving in wages, renewals, meters, and general charges; and altogether he might say the debit side of the account was very satisfactory. Turning to the credit side, the increase in the rental amounted to £7363. At the same time it was right he should state that a certain portion of this increase must be attributed to the slight addition the Directors were compelled to make to the price of gas, but not to any very great amount, because the quantity of gas sold had been very large. They had also a small increase in the public lighting. Passing on to the residuals, coke had shown better results, but not to the extent the Directors had anticipated—the increase having been only £889. Sulphate of ammonia and ammoniacal liquor also exhibited a very satisfactory increase. He was glad to say these products were now rising in the market; and the Board entertained the hope that, when the current half year closed, they would be able to show better returns from them. He had already referred to the question of tar; but he would again mention that the monetary decrease had amounted to £1534. During the six months, 45,125 tons of coal had been carbonized, compared with 45,428 tons in the corresponding period of the preceding year—being 303 tons less. This was partly due to the fact that they had distilled 10,232 gallons of carburine, which would represent about 136 tons of coal; so that the decrease was not quite so much as appeared by the figures. The coal had cost them 14s. 8d. per ton, as against 16s., or a saving of 1s. 4d. Regarding the quantity of gas sold, there had been an increase of 21,019,100 cubic feet, or 5·25 per cent. This was the history of the Company's working during the half year.

Mr. A. T. LAYTON seconded the motion, which was carried without discussion.

On the proposition of the CHAIRMAN, seconded by Mr. JAMES GLAISHER, F.R.S., dividends were declared at the following rates per annum: 6 per cent. on the preference stock, 7 per cent. on the ordinary 7 per cent. stock, and 10 per cent. on the ordinary 10 per cent. stock, all less income-tax.

The retiring Directors were the Chairman and Mr. C. Lea Wilson; and the first gentleman was re-elected on the motion of Mr. G. LIVESEY, seconded by Dr. HETLEY, and the second on the proposition of the CHAIRMAN, seconded by Mr. LAYTON.

Mr. WESCOTT then proposed, and Mr. WILKINS seconded, the re-appointment of Mr. Alfred Lass as an Auditor; and this was agreed to.

Resolutions thanking the Chairman and Directors and the officers and staff for their services were next passed.

In responding to the vote to the officers and staff, Mr. OHREN incidentally remarked that, in December last, he completed his thirty-seventh year in the Company's service; and Mr. GANDON observed that he felt much happier that day than he did twelve months previously, when the report was not by any means so rosy as on the present occasion. So far as he could see, there was every probability that they would do as well in the current half year as they had done in the past six months.

The proceedings then terminated.

PROVINCIAL GAS COMPANIES.

A few additional reports and financial statements dealing with the working of Provincial Gas Companies have reached us during the past week; and the particulars given below have been extracted therefrom.

The report submitted at the ordinary general meeting of the Ascot District Gas Company last Tuesday week showed a profit of £744, which, added to the balance of £728 brought forward, gave an amount to the credit of the profit and loss account of £1306, out of which the Directors recommended a dividend at the rate of 2 per cent. per annum. The Chairman (Mr. Robert Berridge) stated that the profit shown in the report was about the largest they had made for many years. The Directors were exceedingly sorry they could not recommend a dividend of more than 2 per cent.; but they hoped, when they obtained coal a little cheaper, to be able to pay a larger amount. The Company had now been at work for nine years. In the first two or three years, they worked under very great disadvantages, for their works were not completed; but since then they had advanced very rapidly. The profits for the half year ended Dec. 31, 1888, were £552, against £744 for the past half year; being an increase of £191, or 35 per cent. The sales of gas in the December half of 1888 were £1250, against £1776 for the past half year. This was an increase of £526, or 42 per cent. The earlier figures referred to a time when they were charging 5s. 10d. per 1000 cubic feet for gas, against 5s. at the present time. An analysis of the figures showed that the increased profit was 35 per cent., and the increased rental 42 per cent.; so that the profits had increased at a rate of 7 per cent. less than the sales of gas, although coal was more than 10 per cent. dearer now than in 1888. The increased rental averaged 10s. 4d. per cent. per year for the last four years, which must be considered very good under the present conditions of the district. The report was adopted.

The annual general meeting of the Brynmawr and Abertillery Gas and Water Company, Limited, was held at Blaina on the 28th ult., when the Directors reported that the change in the management which took place in July last, by the appointment of Mr. T. Acland, of Rhymney, as Manager and Secretary, would, they had every confidence, prove beneficial both to the shareholders and the consumers of the Company. The accounts accompanying the report showed receipts for gas amounting to £5332—£3539 being for Blaina, and £1793 for Abertillery. The total receipts were £6955; the expenses, £5703—the balance being £1252. In moving the adoption of the report, the Chairman stated that during the latter half of 1892 there had been a sum of £607 spent out of revenue for repairs and renewals. Coals had cost £11 more in that period than in the June half year; but the sales of gas had increased to the extent of £500. Commenting upon this improvement, he stated that the new Manager had already been able to bring the carbonizing results equal to those of any gas-works in South Wales—viz., more than 10,000 cubic feet of gas per ton—from local coals. After providing for dividends at the rate of 5 per cent. per annum, free of income-tax, they were enabled to add £900 to the suspense account. A vote of thanks was unanimously accorded to Mr. Acland.

The proceedings at the half-yearly meeting of the East Ardsley Gas Company were of a very animated character, owing to the defalcations of the late Secretary (Mr. G. H. Tomlinson), to which reference has been previously made in these columns. Mr. Henry Rollinson presided, and said he moved the adoption of the Directors' report on this occasion under very different circumstances from those he had been in the habit of doing. During the half year 6,436,000 cubic feet of gas had been made, as against 5,304,000 feet in the corresponding period of 1891; while 710 tons of coal had been used, as compared with 640 tons. He proceeded to compare various items in the revenue accounts, and then said that the balance of profit was £232, as against £220. This would have left the Directors in a position to pay a dividend of 5 per cent.; but through circumstances of which the shareholders were all aware they proposed that no dividend should be paid, but that the balance of profit and the reserve fund should be encroached upon so as to cover the frauds of the late Secretary. Of course, it would be for the shareholders to confirm or disapprove of this course. Having drawn on the reserve fund, they would have £169 to carry forward after all expenses were paid and all the defalcations cleared off. The Company had the late Secretary's bond for £200, which reduced the amount to rather more than £600. Still, this was a very considerable sum; and doubtless some of the proprietors would have something to say about it. Before concluding, he mentioned that a new gasholder had recently been completed, and was in a most satisfactory condition. The motion having been seconded, a long discussion followed, and numerous questions were addressed to the Chairman, upon the subject of the frauds. In reply, that gentleman stated that the defalcations had been going on since Jan. 1, 1891; and at the bankers there was a deficiency of £663 17s. The fact was the late Secretary had a forged pass-book, which he had made in Wakefield, and which was an exact fac-simile of the real one belonging to Messrs. Leatham, Tew, and Co.'s bank. This book was used by him, but was not taken to the bank. The fictitious book contained different handwriting; so that when it was placed before the Directors and the Auditor, it seemed as if it had been filled up by clerks at the bank. When any money had to be deposited in the original book, he so manipulated it that the bank should have the real book, and that he should remain in possession of the fictitious one. In that way a fraud was committed on the Auditor and the Directors from time to time. They had no suspicions that the signatures were forged, until one small

account of a few pounds appeared to have been settled by a firm of printers. The Directors then found out that the settlement was a bogus one, forged by Mr. Tomlinson; and he was suspended at once, and called upon to resign. The Directors went to the bank immediately, saw the manager and cashier; and in less than an hour's time, he (the Chairman) waited on a firm of solicitors, and afterwards had a warrant issued without the least time being lost. But the man had flown. The Directors had no warning from any customer, except in a private way he was told that the course of life the Secretary was leading would be likely to end in something serious. He took care to tell him over and over again that he thought his course of life was very much against him, and that it was detrimental to his carrying on the business of the Company. The Secretary held 120 shares in the Company, sixty of which he deposited with a gentleman in Wakefield, to whom he handed over the certificates; and he also went and sold the same shares to a Mrs. Richardson, and promised to give her the certificates from time to time but never did so. Mrs. Richardson's name was entered at the bankers; and she received two dividends, which made the Company liable to pay her the money. With regard to the fictitious pass-book, it was so accurately finished off that, when placed before the bank authorities, they could not distinguish it from their own books. Other minor matters were discussed by the meeting, and then the motion was unanimously carried.

The shareholders of the Lewes Gas Company met last Friday week to receive the report of the Directors on the operations of the half year ending Dec. 31 last. It stated that the revenue account showed a profit of £1327; and after providing for interest on mortgages, &c., the balance of net revenue, as shown in the profit and loss account, was £1782. The Directors recommended that a dividend of 4½ per cent. be declared, amounting to £1209, leaving a balance of £573 to be carried forward. In moving the adoption of the report, the Chairman (Mr. J. Broad) explained the difficulties under which they in common with other gas companies had been labouring, and which had resulted in the Directors being compelled to propose a diminution of ½ per cent. in the dividend. The report was adopted.

The Directors' report (which is signed by the Secretary, Mr. A. W. Marks) to be presented to the meeting of the Sheppy Gas Company on the 15th inst., states: during the past year there was a further increase, amounting to about 3,300,000 cubic feet, in the quantity of gas sent out. The total was one-third more than ten years ago; the figures being 36,011,000 cubic feet in 1882, and 49,720,000 cubic feet in 1892. This affords a clear proof that the use of gas is extending; and the Directors make every effort to bring it into greater popularity by furnishing the best kinds of stoves and other appliances on the three-year system. The Company have been put to trouble and expense, and the consumers on several occasions to considerable inconvenience, apart from the risk of serious accident, by the use of an unusually heavy steam-roller on the roads. The favourable working of the past few years, with the great increase in the quantity of gas consumed and the hopeful prospects of continued success, have induced the Directors to announce a further reduction in the price of gas from the end of the present month. Instead of 3s. 8d. per 1000 feet, less 5d. discount for prompt payment, the charge to ordinary consumers will be 3s. 4d. with 4d. discount. The accounts accompanying the report show that the revenue for the past year amounted to £10,252; and the expenditure, to £7125 (of which £3969 was for coals). This leaves a balance of £3127 to go to the profit and loss account. The net amount available for distribution is £1731, out of which the Directors recommend the declaration of full statutory dividends. The quantity of coal and cannel carbonized last year was 5420 tons; the residual products being 4978 chaldrons of coke, 51,557 gallons of tar, and 110,400 gallons of ammoniacal liquor.

THE SMETHWICK LOCAL BOARD GAS UNDERTAKING.

The annual report on the gas undertaking of the Smethwick Local Board for the year ended Dec. 31, 1892, issued by the Secretary (Mr. W. J. Sturges) states that the borrowing powers of the Board were increased by the sum of £6292. An instalment of £529 was paid off, which leaves the total outstanding debt at £161,964, compared with £156,202 for 1891. The capital expended during the year was £5635; bringing up the total outlay on capital account to £167,609. The increase in the quantity of gas sold was 6,822,900 cubic feet, or 4·7 per cent.; that for 1891 being 3·1 per cent. The income from this source was £19,922, against £19,098 for the previous year; showing an improvement of £824. There was a considerable falling away in the income from residual products; the figures being £6931 for 1892, against £7655 for 1891; or a decrease of £724. The decline was entirely on coke; tar and ammoniacal liquor both showing an improvement. The total receipts amounted to £26,905, compared with £26,852 for 1891; being an advance of £53; or adding thereto £551, the value of the coke used as fuel in the regenerator furnaces, £604. The cost of gas manufacture was £15,891, against £16,025 in 1891. Coal rose from £10,123 to £10,532, due to the additional quantity carbonized and the extra cost per ton, together with the larger percentage of cannel employed. The expenses incurred in the distribution of gas were £256 less than in 1891. The management charges amounted to £475, against £433. The total expenditure was £18,833, against £19,087—being a decrease of £254; but the addition of the £551 for coke used as fuel would show an increase of £297. The balance to the credit of the revenue account is £8072—an advance of £307, due to the increased quantity of gas sold. The gross profit for the year was £8072. It has provided the necessary charges for interest and redemption of capital; leaving a surplus of £453, being the net profit for the year. This, with the balance in hand, makes the total to be carried forward £2945. The amount already laid out in refitting the retort-house with regenerative plant is £5651. The Local Government Board sanctioned a loan of £2592 as representing the extra capital value of the new plant over that superseded; the balance of the expenditure (£3059) will therefore have to be liquidated out of revenue at the earliest possible period. It is hoped this will soon be accomplished by the economies to be effected by the improved plant. The works are under the able supervision of Mr. B. W. Smith.

EXTENSIONS AT THE HARTLEPOOL GAS AND WATER WORKS.

Last Thursday, two important additions to the Hartlepool Gas and Water Works were put into operation in the presence of a numerous company. They comprised a gasholder and tank, and a water tower and tank, all constructed from the plans and under the superintendence of Mr. T. Bower, Assoc.M.Inst.C.E., the Company's Engineer, assisted by Mr. C. B. Williamson as clerk of the works. The above-named works have been called for by the rapid growth of the district served by the Company, and the resulting larger demand upon the plant. This will be shown by the following figures: In 1857 the make of gas was 59 million cubic feet; and the consumption of water for all purposes, 289 million gallons. Last year 259 million cubic feet of gas were made; the quantity of water sent out was 909 million gallons. The increase is consequently more than fourfold in the case of gas, and threefold in that of water.

The works have already been repeatedly extended; but, in consequence of the very limited space now available, the Directors of the Company had to look farther afield for a site on which to place any additions. Some three years ago they purchased from Sir F. Milbank 20 acres of land on the Dyke House Estate, adjoining the main line of the North-Eastern Railway, whereon to erect new works as the necessity for them arose. The gasholder and tank now completed constitute the first instalment of the proposed new works. At present, however, and for some time to come, the site will be only used for storeage. The holder is in two lifts—the inner one being 145 feet in diameter and 30 feet deep, and the second one 147 ft. 6 in. in diameter by 30 feet deep; but both the holder and the framing are prepared for adding a third lift, 150 feet in diameter by 30 feet deep. As at present constructed, it is capable of containing 1,000,000 cubic feet of gas; and when the outer lift is added, it will have a capacity of some 1,500,000 cubic feet. The framing, which is of wrought iron and steel throughout, consists of 18 lattice standards 63 ft. 6 in. high, which will be carried to the height of 93 feet when the holder is enlarged. The contractors were Messrs. Clayton, Son, and Co., Limited, of Leeds. The tank is 152 ft. 6 in. in diameter, and 30 ft. 6 in. deep from the finished inside surface at the bottom to the top surface of the stone coping. It is constructed of brickwork and stone built in cement, and the whole is backed by walls of puddle 2 ft. 6 in. thick.

The water tower is an imposing structure occupying a commanding position in the Company's grounds in West Hartlepool, and standing on the site of the first storeage reservoir, constructed about 1847. It has been built to carry a massive cast-iron storeage tank capable of holding upwards of 400,000 gallons of water; this capacity being greater than that of both of the adjoining tanks combined. The building is in the Italian style of architecture, is 98 feet high from the ground-line to the eaves, and is 60 feet square. The tank, which is of cast iron, and is 17 ft. 9 in. deep by 60 feet square, rests on the walls and girders built therein, and is constructed of bracketed and panelled plates, with their flanges (which are all planed) bolted to each other. At the upper edge of these plates, and securely fastened thereto, is an overhanging massive steel wall-plate, attached to which is a strong wrought-iron roof, covered with corrugated galvanized iron sheets, terminating at its apex in a flagstaff. To this is attached a lightning conductor, the terminal of which is about 140 feet above the bottom of the foundations. The tank is divided into four compartments by means of cast-iron bulkheads. Large inlet, outlet, and overflow pipes are inserted in openings in the bottom plates, through which the water passes, on being pumped from the adjoining wells, into the tank prior to its delivery to the town. In its construction, upwards of 11,000 tons of material have been used, which, when added to the weight of water the tank will contain when in use, gives a total weight of more than 13,000 tons.

The ceremony of opening the valve of the gasholder was performed by the Chairman of the Company (Mr. W. H. Fisher, J.P.) and the Mayor of Hartlepool (Mr. E. Nixey, J.P.); that of admitting water to the tank, by Mr. Fisher and Alderman Sir W. Gray, J.P.

THE FINANCES OF THE MANCHESTER CORPORATION GAS AND WATER DEPARTMENTS.

Local Government Board Inquiry.

Last Wednesday, an inquiry was held at Manchester, by Mr. S. J. Smith and E. Pearse Burd, Inspectors of the Local Government Board, in connection with the application by the Corporation for the repeal, alteration, and amendment, by Provisional Order, of certain local and confirming Acts of Parliament, with a view to making other provision as to the setting apart of sinking funds in connection with the loan debt for improvement purposes, and as to the borrowing and repayment of the debt. Various Acts required to be dealt with, so that arrangements of this kind might be made as to the loan debt with respect to the Longdendale Water-Works, and as to the payment and redemption of any annuities granted by the Corporation to raise money in respect of the Longdendale and the Thirlmere works. Alteration of the Act of 1875 was also asked for, to enable the Corporation to borrow further sums for gas-works purposes.

Evidence regarding the sinking funds of the Improvement and Town Hall Committees having been given,

Sir *J. J. Harwood* was called on behalf of the Water Committee. He said the Thirlmere works were now approaching completion; and if there was a good summer and a fair winter, he dared say the works would be finished about next March or April—that was, twelve months from now. All the tunnels, the cut-and-cover, and the aqueducts for 50 million gallons of water were finished; and all the pipes were laid, with the exception of something like 100 yards. About 40 miles of pipes had been tried and found water-tight and very satisfactory. The reservoir to which the water would be brought at Prestwich was also finished, and had been tested and found water-tight. With the completion of the Thirlmere works, the Committee had fully considered the

financial question. The increased expenditure on Thirlmere, including the purchase of land, parliamentary and other expenses, and contracts, would add about £106,000 a year to the expenditure of the Committee—that was to say, sinking fund, interest on money, and so on. As the Inspectors would be aware, if they had a larger income than expenditure, they would have to lower the price of water. This they had for some four or five years up to last year; and the Committee therefore spent more than they were accustomed to do upon the works at Longdendale. They renewed the watercourses, and carried out a great many repairs, spending about £8000, where the ordinary expenditure was from £1500 to £2000 a year. This money would have only reduced the price of water by a very small amount; and they would have had to increase it again, so they did more repairs in anticipation, in order that they might not have to lay out money when that very large increase came upon them. The Longdendale works would be quite as valuable when they had Thirlmere completed as they were at the present time. They were worth more money to-day than at any former period by a very large amount. They had cost £3,160,000, spread over a long period of years. With regard to the Thirlmere scheme, the Corporation had been before the Local Government Board on several occasions, and had explained the matter so as to show that, when the Water Committee had the maximum amount to pay, they had the minimum amount of income to meet it with. What the Committee were now seeking for was that they should have a maximum amount of means when they had a maximum amount to pay. The present sinking fund for Longdendale was £35,816; and they proposed, in lieu of this sum, to pay £12,276 for a period of ten years, so as to afford them temporary relief. At the end of ten years, they intended to increase the sinking fund by about £5000 a year, in order to provide a sinking fund for the old Companies, whose debt had not been liquidated at the present time. They would then have to pay £17,762 per annum. What the Committee were anxious to do was to give the benefit of the large increase of water of better quality without interfering with the price or the rates. The relief asked for would materially assist them in the future administration of the water-works; and unless they could get relief, they would be driven to do a very unpleasant and undesirable thing—that was, increase the rates. However, they could only increase them within the area of the city; and therefore the half million people outside would reap the benefit of the increased taxation.

Alderman *Leech* also gave evidence for the Water Committee.

Mr. *J. Brooks*, Chairman of the Gas Committee, was next called with reference to the application to borrow an additional sum of £500,000 for gas-works purposes. He said the recent amalgamation with the city of the townships of Crumpsall, Blackley, Moston, Newton Heath, Clayton, Openshaw, Kirkmanshulme, and a portion of Gorton had added 6851 acres, which now made a total of 12,788 acres of the city area. The amalgamation also added 105,500 to the number of the population; making a total population within the city of 484,300. At the time of the incorporation, there were 11,228 gas consumers in these townships, which had since been increased to 12,051; being an increase of 823, or 7·33 per cent., in two years. The total number of gas consumers in the city was 65,418; and beyond the city, 15,153—making a total of 80,571. Consequent upon the incorporation of the above townships with the city, the price of gas in those townships was at once reduced from 3s. to 2s. 6d. per 1000 cubic feet; and this had resulted in a large increase in the consumption of gas. The quantity of gas consumed in these townships during the year immediately preceding the amalgamation (1890) was 296,478,000 cubic feet; in the year after amalgamation (1891), 341,980,100 cubic feet; and in 1892, 366,190,600 cubic feet—a total increase of 69,712,600 feet in two years, or 23·5 per cent. over the year 1890. There was also a large increase in the consumption of gas arising from the number of houses and business premises which were annually built, especially in districts more or less remote from the centre of the city, which had caused an increase in the consumption of gas in ten years of 929,654,000 cubic feet; being 37·6 per cent., or an average increase of 3·7 per cent. per annum. During the year ended March 31, 1892, the increase in the consumption of gas was 3·12 per cent. on the previous year; and from March 31 last to the present time, the increase had been 8 per cent. During the past two or three winter months, the manufacturing and storeage capacity of the works were inadequate to supply the quantity of gas required, or the increase in consumption would have been still greater. In order to meet the growing demand for gas, it was absolutely necessary that the Gas Committee should take immediate steps for increasing the manufacturing and storeage capacity of the works, to put down larger mains in the vicinity of the works, and also to increase the size of, and to extend the mains to and in the more distant areas of consumption. From the year 1882 to 1892, inclusive, the sum of £462,313 had been spent on capital account for the extension of works and mains; being at the rate of upwards of £46,000 a year, about £15,000 of which had been expended per annum for the extension of mains. It was expected that the rate of consumption would be still further accelerated by the use of gas not only for illumination, but for heating, cooking, and motive power. The manner in which it was proposed to lay out the sum of £500,000 was as follows: Bradford Road works, £135,000; Gaythorn works, £35,000; Rochdale Road works, £50,000; Droylsden works, £17,000; street mains, £20,000 a year for ten years, £200,000; meters and stoves, £5000 a year for ten years, £50,000; miscellaneous works, £15,000—total, £502,000. In reference to the item miscellaneous works, he said it should be stated that the Gas Committee were under the necessity of making experiments and trying new machinery. They had now in hand an oil-enriching process to supersede the use of expensive cannels. They had also under consideration a water oil-gas apparatus, and must be in a position to adopt any new process in relation to illumination and purification, &c. The works were all maintained in the highest efficiency out of revenue. The term asked for the loan was 55 years, as on the former occasion; but the Corporation desired the usual alternative of a cumulative sinking fund.

Mr. *C. Nickson*, the Superintendent of the Gas Department, gave in evidence a variety of details connected with the operations at the gas-works, showing the necessity for carrying out the proposals made.

One or two other matters engaged the attention of the Inspectors; and the inquiry then terminated.

CITY OF ST. PETERSBURG NEW WATER COMPANY, LIMITED.

The Transfer of the Works to the Municipality.

The Ordinary General Meeting of the above Company was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. W. T. WESTERN in the chair.

The annual report of the Directors and the accounts (of which a notice appeared in last week's issue) were taken as read.

The CHAIRMAN said the report referred to two things—First, to the working of the concern during the past year; and, secondly, to the terms on which it had been agreed to transfer the undertaking to the Municipality. These two matters were interdependent, because the second depended upon the first. As to the revenue account, it would be seen that they had maintained a very fair rate of increase in the business; the receipts having risen from 255,420 to 270,653 roubles. On the other hand, the expenditure was rather less than in 1891—not that they had in any way starved the works, but it arose from two items in the repairs account. In 1891, the breakages of pipes from frost were greater than last year; and in the former year, they had to renew one of the pumps. The net result was that, on the revenue account, they were about 15,000 roubles better off than in the year before; and this, he believed, the shareholders would consider satisfactory. There was not much difference in the profit and loss account, excepting two of the items—one being the balance of the legal expenses (£250) arising out of the long suit with the Municipality regarding the right of the Company to a charge for meters, which was ultimately decided in the Company's favour; and the other item was the expenses incurred in connection with the transfer of the undertaking (£371). After paying all the debenture interest for the year, there was a profit of £8708, which, under ordinary circumstances, would have been available for the shareholders, but which they were using for the purpose of paying off the arrears on the "B" debentures; so that this item now disappeared from the accounts. Respecting the transfer of the works, the negotiations had been going on for about twelve months. The basis of the negotiations was, of course, the original concession from the town; and it turned upon what would be the revenue of 1892. A proposal was made in the course of the discussion, that they should take the 1891 accounts, adding an estimated percentage of increase in the rental; but both the Commission dealing with the matter on behalf of the Douma and the Directors preferred to take the 1892 accounts. The result was that the actual sum of the annuity was not quite fixed, and could not be until the accounts were approved that day. They took the accounts of the first six months, and multiplied the revenue by two, and that was how they estimated the sum the Douma were to pay the Company up to the termination of the concession in 1917 (168,592 roubles). The revenue, however, for the past six months had really been a little less; so that the figure would now stand at rather more than 166,000 roubles. He thought the Board had made the best possible bargain. The subject that was probably most discussed between the town and the Directors was the thorny point of "extra" works. They could not arrive at a basis for dealing with these; and eventually the Company were offered the lump sum of 100,000 roubles to settle them. The Board decided to accept this figure, so as to avoid the expense of arbitration or litigation. The Municipality also bargained that they should have the continuous right of commuting the annuity. The Directors did not know what they were going to do in this matter; but what they did know was that it was to the interest of the town to commute it, because they could raise the money at a less rate than they were paying the Company. Therefore, there was no doubt they would do it at the earliest opportunity. The Directors made arrangements for discharging the staff; and the works were handed over to the town authorities on the night of the 31st of December. Stores, &c., had been taken by them at a valuation; and the Board had taken steps to dispose of the materials not required. During the negotiations, and indeed during the whole time he had been in the Company's employ, the Directors had found the services of their Manager (Mr. G. A. Carr) of inestimable value; and they were going to ask the shareholders to recognize these services by a special grant. The staff were also scattered, and out of employment. The Municipality, while they paid them the greatest compliments on the condition in which they found the works, would not take a single Englishman into their employ—the national prejudice being so strong. He would now ask the shareholders to approve, in the first place, of the report and accounts presented, so far as they dealt with the year's working.

Mr. R. S. GUINNESS seconded the motion.

The CHAIRMAN, in reply to questions, said the Directors had the written agreement of the Municipality to pay the half-yearly instalment of the annuity; and, in his opinion, their guarantee was about as good as could be obtained in Russia. As to how they proposed to deal with the annual income—assuming they did not get a lump sum—it would be applicable first to paying the interest on the bonds. The amount of that at present was £7800 a year; but this figure would in future be less, as they were paying off bonds out of the sum received for the "extra" works. Next, they had to provide a sinking fund for redeeming the bonds; and the remainder would belong to the shareholders. Assuming the exchange to be at an average of 10 roubles to the pound, there would be £6500 a year, out of which they would only have to deduct the expenses of the London office, which would be very small. The annuity, he added, was not a perpetual one, but it would run to the end of the concession (24¾ years), and that was worth some 14 years' purchase.

The report and accounts having been adopted,

Resolutions were passed, approving of the terms of the transfer of the undertaking to the Municipality; sanctioning a special grant of £1000 to the Manager (Mr. Carr), in recognition of his services to the Company; and authorizing the payment of gratuities to the staff, not exceeding one year's emoluments.

The retiring Directors (Messrs. Western and Darley) and the Auditors (Messrs. Cooper Bros. and Co.) were re-elected.

This concluded the proceedings.

THE METROPOLITAN WATER SUPPLY COMMISSION.

(*Lord* BALFOUR OF BURLEIGH, *Chairman*; *Sir* G. B. BRUCE, *Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH, *Commissioners.*)

Twenty-ninth Day—Wednesday, Feb. 15.

On the resumption of the inquiry to-day,

Dr. *Frankland*, in accordance with a promise made to the Commission last year, submitted an additional statement bringing down to the end of January last the results of his experiments detailed when previously before the Commission; leaving three months to complete the year of experiments. He said the observations he had made since he was last before the Commission had confirmed and emphasized the provisional conclusions he had then come to. At the beginning, his mind was in a very open condition, inasmuch as he had made but few experiments in the direction in question, and especially with the water issuing from the filters of the Water Companies. The results of the nine months' experiments were consistent with one another; and he did not think there was anything in them to lead him to expect any difference in those for the next three months. They were, on the whole, very conclusive, though there were a few exceptional cases. One comparison of the results of the observations showed that the numbers of microbes found in the water taken from the stand-pipes were invariably greater than the numbers found in the samples from the filter-wells of the Companies and in the works themselves. There could be no doubt there was a considerable multiplication of microbes either in the service reservoirs or in the mains of the Companies between the filter-beds and the stand-pipes. Another demonstration was that there was a greater consistency, as regarded bacterial results, in the case of the Kent Company's deep-well water, than in that of the river waters; but he drew special attention to the fact that filtration of Thames water, if efficiently carried out, produced a beverage which was practically very slightly inferior to deep-well water. The Chelsea Company's water was usually of a degree of purity, in regard to microbes, but little inferior to the Kent Company's water. This could not be said of the water of all the London Companies.

The CHAIRMAN observed that attention was also called to some extraordinary variations. In one case, the number of microbes which passed through a filter was 996 per cubic centimetre. This was, he thought, the worst example.

Witness pointed out that there was one case in which the number was 1220, which was the highest. There were two abnormal results, which were, no doubt, due to some serious defect at the time in the process of filtration. What it was he could not be certain; except in the first case—that of the 996 microbes. He ascertained that a filter-bed was being re-laid or re-excavated, and that water was being pumped, by means of turbines, out of the well from which his sample came, and there was a far too rapid rate of filtration going on.

The CHAIRMAN: If I understand rightly, comparing that sample with a sample of unfiltered water taken on the same date, filtration in that case had only removed about one-third of the living organisms from the unfiltered water?

Witness: Yes; there were 2421 microbes to the centimetre in the unfiltered, and 996 in this sample of filtered water.

Is it fair to compare the unfiltered with the filtered water, as in this case? Is the water of the one the same as the water of the other? It is very difficult to say. The sample of the unfiltered is from the water going on to the filter at the time the sample of the filtered was taken; and there is some storeage, though only for a short period, between the raw water and the filtered. Filtered waters, therefore, are not strictly comparable with unfiltered, although I believe they are practically so. The sample with the 996 microbes and that with the 1220 microbes are the only recent instances of what I will describe as inefficient filtration. There was a case of the East London Company in December; but I cannot doubt that it was brought about by some exceptional circumstance, because their filtered water is usually very good in respect of microbes. If the experiments were continued for another year, the probability would be that the abnormal numbers of microbes mentioned would not be found again, or anything like them; the alterations in the filtration plant where they occurred being in progress, and likely to be soon completed.

Do your experiments lead you to suggest to us any possible recommendation as to any greater safeguards and securities than are being at the present time put in force?—Yes; I should like to suggest that double filtration at least, in certain cases, would be very desirable for the London Water Supply. If, when the abnormal numbers of microbes mentioned occurred, a spare filter had been available on which the imperfectly filtered water might have been turned, the exceptional appearance of microbes would have been prevented.

As a matter of course, the exceptional appearance was not known of until your experiments betrayed it?—Possibly.

Do I understand your recommendation to go this length—that careful watch should be kept to see that filtration is efficient, and that, if any suspicion to the contrary occurs, recourse should be had to a second filtration? Or do I understand you to say that a double filtration should, if possible, be carried out?—That is what I should like, if one might have all one wished for; but certainly occasional double filtration is very desirable indeed.

Questioned with regard to the effect of temperature upon the microbe organisms, witness mentioned that it appeared that, the lower the temperature of the river waters, the greater was the number of microbes or their spores present. This had been again confirmed, so far as his experiments had gone; and he confessed he expected the reverse.

The CHAIRMAN: I should have thought a temperature of about 55° to 60° Fahr. would be the temperature at which these organisms multiplied with the greatest rapidity?—Yes; but the reason of the enormous number being found in some of the samples may be that the spores are prevented from developing at the time and so there gets into the water a greater accumulation of spores, which cannot be distinguished from developed bacteria by gelatine plate culture. Therefore I think that, as regards the raw river waters at any rate, the probability is that the cold prevents a great destruction of one class of spores by another which would otherwise take place. Filtered waters are also charged more with microbes in cold weather than in warm; and this may be through the material on the surface of the filter being in an abnormal condition in the cold weather, when a larger number of microbes would pass through than at other times.

Proceeding next to speak of the relative advantages of storeage and filtering capacity, witness pointed out a curious circumstance—that some of the Companies whose filters were cleaned most frequently delivered by no means the best water. He then went on to illustrate that two Companies with the same storeage capacity would send out water of different bacterial quality, if the thickness of their sand filtration varied. The Company which employed the thickest stratum of sand in their filters supplied water with the smallest number of microbes on the average. There were two governing conditions—amount of storeage and thickness of sand; and where, as in the case of the Chelsea and East London Companies, there was equality in the storeage and a difference in the sand (the Chelsea Company had the thickest sand, and delivered water into their mains with a smaller number of bacteria per cubic centimetre than did any other Company), it was fair to say that the difference in the thickness of the sand was the main, or a very powerful, governing cause of the difference in the water. Storeage capacity, to be a sufficient protection, must be supplemented by efficient filtration. At the same time, it appeared that greater bacterial purity was in large measure due to increased storeage. The West Middlesex Company had twice as much storeage as the Grand Junction Company, and, as a rule, delivered water of a greater bacterial purity than the Grand Junction Company. But it had also to be remembered that chemical purity and bacterial purity did not go *pari passu*. They might in some cases have greater chemical purity combined with greater bacterial impurity. The chemical purity of the waters of the West Middlesex and Grand Junction Companies was shown to be identical; but the average bacterial quality of the former was four times as great as that of the latter, because the former had much the larger storeage capacity, and also filtered at a lower rate. So that the storeage capacity would apparently be, on the whole, the most important factor in the diminution of microbes; and slowness of filtration was another factor which was of somewhat less importance. Asked whether, from his experience and his knowledge generally, he could lay down any standard, in the matters of storeage and filtration, which should be provided to make sure of giving efficient water, witness instanced the Chelsea Company as a model one in regard to filtration, and also as the best as regarded storeage; but he observed that even the storeage capacity of that Company was not always sufficient, because they had occasionally to take in flood water, and then the quality of the water they sent to London was considerably deteriorated chemically.

The CHAIRMAN: On both points you would recommend, if you could have everything you wish, something even better than the Chelsea Company have at present?

Witness: Yes; they want more storeage capacity, and the opportunity of double filtration where necessary. When a filter is newly cleaned, it appears that for a day or two the filtration is imperfect—that microbes get through; and then on these occasions I should think that the water from the newly-cleaned filter should be filtered a second time before being delivered.

Interrogated by Professor DEWAR, witness said it seemed to him that sufficient filtration depended upon two things, looking at the results of the bacterial experiments so far as they had gone—first, thickness of sand; and, secondly, a coating of some gelatinous organic substance upon the surface of the filter, which arrested microbes so that they did not get into the sand. He had not examined to what depth this gelatinous surface membrane went; but his experiments were confirmatory of others which had been made at the Pasteur Institute and by Continental observers, showing that the efficiency of the filtration was intimately connected with the gelatinous film of living material on the surface of the filter. His experiments also proved, concerning the alleged oxidation of organic matter, that 90 per cent. of it was brought about by the efficiency of bacterial life of some kind, and mainly by the nitrifying organisms, and that, if there were no nitrifying organisms, no amount of filtration through a purely sand filter would do any good. So that, if they had a perfectly purified sand in the filtering process, he should expect no purification at all—no efficient bacterial or chemical purification. Replying to further questions, witness gave as the result of his general bacterial examination that every average below 50 microbes per cubic centimetre of water was a satisfactory purification. To go to the length of doubling the storeage capacity, and adding to the thickness of the filters in order to change the microbes from 16, as in the West Middlesex, to 9, as in the Chelsea, would perhaps be rather an extreme measure to take.

Mr. MANSERGH: Is the rate of filtration the same in both cases?

The CHAIRMAN: The Chelsea Company's rate is 1·75; that of the East London, 1·73; the Grand Junction, 2; the Lambeth, 2·16; the New River, 2·13; the Southwark and Vauxhall, 1·5; and the West Middlesex, 1·27.

Professor DEWAR: That is a much smaller rate of filtration than any of the others—1·25, as compared with the Chelsea Company 1·75.

Witness: It is substantially identical, as far as the value of these analyses goes.

Mr. MANSERGH: Do you know the length of time between the cleansing of the filters of the two Companies?

Witness: The Chelsea Water Company clean annually 2·8 acres for 1,000,000 gallons of water filtered daily; and the West Middlesex Company, 6·2 acres. Therefore they clean their filters very much more frequently than do the Chelsea Company.

Professor DEWAR: They would not clean their filters if they could avoid it. Therefore they are filtering at a slower rate, they have a smaller thickness of sand, they are cleaning their filters more frequently, and have only half the storeage of the other; and yet substantially the number of microbes is equally satisfactory.

Witness said this was so. At the present time there were a variety of variable functions which had to be taken into consideration; and the question was too complex to be absolutely certain, without further research, what was the best combination. In general terms, however, so far as modern science had advanced in this department, he

considered the filtration of the London waters was generally highly satisfactory.

Professor DEWAR, referring to the question of the filtration of the Hamburg water, asked witness if he knew of any case of epidemic disease having been traced in a community which had been supplied with river water after it had been subjected to the same conditions as the London supply.

Witness replied that he did not know for certain of any epidemic disease arising in a town under those conditions; but it must be remembered that, in two or three cholera epidemics in London, the water was sent through filters.

Professor DEWAR said he did not wish to go into the history of past epidemics. His question applied to the last 15 years, during the time witness had examined the water chemically.

Witness said he did not know of any epidemic under the circumstances referred to, though, of course, there had been no cholera in England during that time. The case of Altona, as compared with Hamburg, was an exceedingly instructive one, and required to be carefully noted; that case being a very severe test of the practical efficiency of filtered river water.* The public need have no fear, if the water was properly filtered, of epidemic disease being produced from river water; and with filtration as carried out in London, they need not be apprehensive of any epidemic of cholera in the Metropolis this year. At Hamburg they were now constructing filters according to the London method. The great obstacle the London Companies had to contend against was the flood waters.

Professor DEWAR: You think the proper mode, as I understand, of relieving the necessity of rapid cleaning of the filter-beds, and other causes at the same time, is to increase largely the storeage capacity.

Witness: Yes; unless you have a very large storeage capacity, you cannot at all times let the flood water go by, because the floods last sometimes more than 15 days. By increasing the storeage capacity, you may let the worst of it go by; and then, providing there is perfectly efficient filtration also, you can deal with the remainder of the flood. Referring to Mr. Dibdin's evidence, witness proceeded to say that he entirely agreed that there had been a great improvement in the water delivered by the Companies, although the raw Thames water was actually worse than in 1891, when he was strong in his condemnation of the supply; but he did not think the Companies had been put to such a severe test as they were in 1891.

Professor DEWAR: With regard to your views as to the future supply, or an additional supply, of water to London, would you summarize them for the Commission?

Witness: I would summarize them by saying that, in my opinion, there is in the Thames basin an ample supply of excellent water for the wants of the Metropolis for the next hundred years at least, and that there is no necessity to go outside it.

What would you suggest ought to be done to increase the future supply of water?—I would suggest that adits should be driven into the chalk and oolite formations, so as to deplete these formations of their water in wet seasons, and leave room for the storeage of fresh rainfall afterwards. You can, in fact, treat those formations as reservoirs—the chalk formation as a sort of inverted reservoir, or sponge; and the oolite formation as a reservoir of ordinary construction, its fissures retaining the water. In an ordinary reservoir, if you keep it full to the overflow dam, it is quite obvious that you cannot store in it more than an amount of rainfall which represents the quantity of water that you are abstracting from the reservoir; but if you keep it low, you can impound flood water to an enormously greater extent. That is what I conceive to be possible, by the driving of adits and the sinking of wells in those formations, to be done with these "natural reservoirs," as they may be called.

So you have no hesitation in expressing the opinion that there will be no dearth of water to be found in the valley of the Thames?—I have no doubt.

And of good quality?—And of good quality, if you like to take pains to procure it of good quality.

Replying to Mr. MANSERGH, witness stated that, so far as experiments had gone, it seemed to be the fact that the filters were more efficient in the removal of micro-organisms the longer they were going. The stopping up of a filter depended probably upon two causes—first, upon the deposition of mineral and dead matter suspended in the water; and, secondly, upon the growth of the organized skin upon the surface. The organized skin might grow just as fast with the water that had been longer stored. But the stoppage from the suspended matter would, of course, be very much less; and therefore the result would be that a filter would go longer if the water was stored longer. He had experimentally demonstrated that filtration through 100 feet of gravel was equal, in securing purification, to the flow in a river of 100 miles. The water taken out of the gravel by the Southwark and Vauxhall Company he found to be infinitely superior to the filtered river water, both bacterially and chemically. On many occasions, the water which that Company pumped out of the gravel without any further filtration was bacterially very much purer than that which they sent out to their customers after filtration. He did not know whether the water he examined had come naturally out of the gravel, or had been artificially put into it, or whether it was a mixture of both.

Questioned by Mr. HILL as to whether he was satisfied with the inspection of the watershed by the Thames Conservators for the prevention of pollution, witness stated that, while he did not think everything was done that might be, the Conservancy had accomplished a great deal in preventing crude sewage from reaching the river. Nearly all the sewage entering the Thames was now treated at least chemically, and passed over or through land; and this had been brought about to a large extent by the efforts of the Conservancy. He understood, however, that their powers did not extend to the head waters of the affluents of the Thames. This was a very important matter, because the streams became polluted very soon after leaving their sources—while they were mere trickling rivulets. If the water could be first passed through gravel, he considered it would be a great improvement to the London supply; and, as far as his experiments went, this would be a very efficient first filtration—taking up about 98 per cent. of the microbes. As to the abstraction of the water from the chalk which he suggested, he did not think, from an agricultural point of view, the surface of the ground would be affected; but it would no doubt interfere with wells which happened to be sunk in the neighbourhood of the adits or deep wells. He thought the streams of the country would be affected, because the springs from which they derived part, and in dry weather the whole of their supply, would, of necessity, either be stopped altogether, if the level of the water in the strata were lowered very much, or would discharge at a slower rate than at present.

In reply to Sir A. GEIKIE, witness said there were very few streams in the chalk districts, or scarcely any beginning on the chalk; but there were some which flowed on impervious strata, and which ran into the chalk and entirely disappeared.

Sir A. GEIKIE: A good deal of pumping might take place, might it not, in the chalk, without affecting the general surface drainage of the chalk, which in dry weather can hardly be said to exist?

Witness replied that he did not think the rivulets, if there were any, would be affected, nor would the general agricultural conditions of the chalk district.

In reply to the CHAIRMAN, witness stated that his experiments showed the condition of the water when it was delivered into the mains.

The CHAIRMAN: Not necessarily into the mains; it may be into the service reservoir?

Witness: Yes; but the service reservoirs are so very small that you might almost regard them as parts of the mains. In certain instances, the water would be delivered within two hours after leaving the filter-beds. In some cases it is pumped directly from the filter-wells into the mains, without any service reservoir at all, except perhaps one acting as a shunt.

Assuming that, after filtration, the water remained 12 or 14 hours before it was used, and that when filtered it had been of the bacterial purity which you indicate, what would be the effect of its waiting 12 or 14 hours on the standard of bacterial impurity?—That would depend upon the temperature. If it were from 45° to 65° Fahr., the microbes would multiply to a very considerable extent, and probably they might be a hundredfold in that time.

So that if it happened that one of these less favourable samples, containing 996 or 1272 colonies to the cubic centimetre, stood at a favourable temperature for 12 hours, it might return, so far as these organisms are concerned, back into the state of unfiltered water?—Yes; it might contain as many microbes as the river water. But the point that strikes me with regard to filtration is that you diminish the microbes to a small minimum, and the chances of any of these being pathogenic are very slight; and therefore if those microbes are non-pathogenic ones, it does not matter how much they multiply.

But if one does get through, it will multiply first as a non-pathogenic one would?—Recent experiments seem to go in the opposite direction. These pathogenic organisms seem to be of a more delicate constitution, and to be attacked by other organisms, and when put into water containing those other organisms they distribute very rapidly. Therefore, if a single pathogenic organism were present in the Chelsea Company's water containing nine microbes to the cubic centimetre, there would be eight others which would multiply at a greater rate; and consequently the pathogenic organism would not have much chance of continuing its life.

Professor DEWAR: The environment of a water supply is not quite a fit *pabulum* for the development of the pathogenic organism?—No, it is not. The nature of that organism is, of course, to develop in the body of an animal, and not in water. The typhoid organism, for instance, will develop in river water which has been artificially freed from other microbes; but if other microbes are present, it will be eaten up by them.

It is the survival of the fittest?—Yes.

And the survival of those things that are fittest in water is not objectionable?—No; that appears to be so.

Replying to the CHAIRMAN, witness stated that in November and December, 1892, he received and reported upon 36 samples of water, specially sent to him by General Scott, collected in various parts of the districts and from the filters of the Companies; and the reports which he made upon them to the Local Government Board could be procured by the Commission. He did not think there was anything in them which would show a different result from that which he had laid before the Commission.

Mr. *A. R. Binnie*, the Chief Engineer to the London County Council, was next recalled, and submitted a printed statement with regard to the proposed reservoirs at Staines, and also a table showing the natural flow of the Thames at Teddington Weir. Comparing the table with proposals in the "new scheme," he affirmed that, under that scheme, occasions would frequently arise when one of two things must happen—either the clear dry-weather flow of the Thames must be abstracted for the water supply of the Metropolis, and so reduce the 200,000,000 gallons a day which the scheme proposed to guarantee for the supply of the river, or the Water Companies would be under the necessity of taking from the river into their works flood water in a polluted condition. Viewing the subject from this point, it was quite clear, witness stated, that, if the scheme were adopted, additional storeage would be required; but the matter did not rest there. Already they had experience of the effect produced by the abstraction of 100,000,000 gallons a day from the Thames; and if, in addition, a quantity of 200,000,000 gallons was taken, some compensation must be afforded to the river. The abstraction would be felt in the lower reaches between Teddington Weir and Blackwall; and it was only by the continued accession of clean water to this stretch of the river that its purity in summer could be secured. Tidal action would, no doubt, more or less fill this part of the river; but tidal action by itself would not cause an ultimate current down the stream, but rather set up an up-and-down movement of water, which would have the effect of carrying any impurity it might contain continually backwards and forwards through the most thickly-populated part of the Metropolis. He added that he was of opinion that no good would result to the river by impounding tidal water, as had been proposed, at the Old Deer Park, below Richmond, as this would only be tidal water, and not the comparatively pure flow of the river from its upper reaches, which he considered so important for the purity of

* Some particulars of this case will be found towards the close of a lecture delivered by Dr. Percy Frankland, reported *ante*, p. 67.

the river. He also again protested against obtaining a supply of water in perpetuity from the open rivers—the Thames and the Lea—on account of the polluted nature of the flood water which came down these rivers, and which was bound to increase in the future with the growth of the population.

General *A. De Courcy Scott*, R.E., the Official Water Examiner under the Metropolis Water Act, 1871, described his duties. In speaking of his procedure in taking samples for inspection, he explained that he went to places where the water issued from the filters. He did not take water from the mains and pipes; this was done by Dr. Frankland. He had also had to discharge extra duties. For example, in 1891, he conducted for the Local Government Board an inspection of sewage farms in the valley of the Thames; visiting the area surrounding each of the intakes of the Water Companies. The impression then left upon his mind was that the standard of purification was by no means so high as it might be, or even as it should be made. This was due in some cases to the sites of the works; in others, to the area; and in others, to the arrangements for the management. The results were not so good as they ought to be; and it happened that his inspection took place at a period when the weather was favourable for the purification of the sewage—it was dry, open weather, with no frost. Looking at what took place, and carrying one's imagination forward to what might be under unfavourable circumstances—when, for instance, there was heavy rain, when the river was in flood, and when there was frost—it was impossible to avoid the conclusion that at such a time the effluents would be anything but satisfactory. The management arrangements had undoubtedly been of considerable service; but they were far from being so effective as perhaps they were hoped to be, and as he thought they might be made. In certain cases, some of the effluents reached the streams in such a condition as to add pollution to the river. Asked if he could put his finger upon anything of general application which he considered was a source of weakness, he said one practice which he thought was objectionable was the leasing of the sewage farms to private individuals for the purpose, he presumed, of deriving what profit they could from the cultivation of the land. He could not conceive that, in a practice of the kind, there could be such a sacrifice of personal interests as would lead to the purification of the sewage. Another thing was, he thought, that they required higher skill than was generally exercised on the sewage farms—a greater application of scientific knowledge than could be displayed by the class of people left in charge of the works.

The CHAIRMAN: The system rather encourages one to get rid of his own mess as best suits himself, without much care as to what becomes of his neighbour?

Witness: There is that feeling, no doubt. I cannot say, if you put it on that ground, that the interest of a local authority lies in discharging a pure effluent. It does not hurt the authority if the effluent goes away, and the neighbours have to deal with it; and, in these circumstances, the general standard looked upon as good would not be quite what the drinkers of the water might consider sufficient.

Would you agree that the Thames Conservancy and officials have done no inconsiderable work to reduce pollution?—Yes.

They have suggested that their action has been hampered through want of means and power, and defects in Acts referring to the pollution of rivers. Would that also be in accordance with your knowledge?—I think so. Witness added that his inspection led him to the conclusion also that in towns and villages there was a large amount of surface contamination—that there was a state of things there which, when there was heavy rain coincident with flood in the river, would lead to a very rapid and considerable increase in the pollution of the water which went into the river. Further, as regarded the pollution, he could not conceive that, in the upper part of the Thames, there should be anything to prevent proper sites for sewage works where they were not already established. With respect to the efficiency of means used by the Water Companies for taking unclean matter out of the water before delivering it to the consumer, he observed that the Companies were by no means on an equality in point of power of dealing with the water when it was in a bad condition—that was to say, that an objectionable fluid in the river would tell much more largely and rapidly on one Company than on another.

Can you tell us whether that is due to the power of storing water, to the rate of filtration, to the thickness of the sand in the filters, or to one or other of those things, or in what ratio to one or the other?—I do not think it is possible to assign a purifying power to any particular factor—whether thickness of sand, or storeage capacity, or area of filters—for the reason that the resulting water is, as it were, affected by all these things in combination.

Are you able to specify any amount of storeage capacity, any rate of filtration, any thickness of sand, or any other condition which ought to be the minimum accepted?—I think there is grest difficulty in stating dogmatically what ought to be the particular plant a company should possess, because I think the value of each factor relatively to the other is practically not determined. I consider that, before any theory is laid down as to the plant the Companies ought to have, the value of each factor should be determined separately. Subsequently, witness remarked that the circumstances in which the Water Companies had been placed in late years rather militated, he thought, against the extension of works, which was desirable in several places. The Companies had been in doubt as to the ultimate fate in store for them. But he emphatically said that, if the Thames and the Lea continued to be sources of water supply for the Metropolis, there ought to be no stint whatever in providing works for purification; and considerable extension of these was required.

Asked by Sir G. B. BRUCE if he had formed any judgment as to what should be the area of filters for an average supply, witness said that, in the absence of practical experiment with regard to the value of any kind of purification plant, he had gone on the principle that, if one Company considered it desirable to have a certain area of filters, it was reasonable that the other Companies should have a relative quantity. If one Company deemed it necessary to have 15 days' storeage for their own purposes on their own motion, he thought it perfectly reasonable that the others should be called upon to have a similar quantity.

Has any one Company provided an excess of filter area beyond the others which you would hold up as a pattern?—I should like the Companies to adopt, as far as practicable, the system of the Grand Junction Company.

In reply to Professor DEWAR, witness remarked that he was not aware, within his experience, that the water of the Thames had at all deteriorated; neither did he think that, on the whole, the filtered water supplied by the Companies had done so, in his experience.

Professor DEWAR: Will you say that it has improved, within your experience?

Witness: I think it has been tolerably satisfactory.

At the close of this evidence,

The CHAIRMAN announced that the Commission would now adjourn, and, as then advised, would not hear any further witnesses; but, if it was found necessary to alter this decision, proper notice would be given of any future sitting, and the evidence required would be taken in public.

THE LEICESTER MAIN DRAINAGE WORKS.

At the Meeting of the Society of Engineers on Monday last week—the President (Mr. W. A. Valon, J.P.) in the chair—a paper on the above subject was read by Mr. E. G. Mawbey, Borough Engineer of Leicester. The author commenced by referring to the great prosperity which the borough has enjoyed for some years past, and to the rapid increase that has taken place in the population, which now numbers 180,000; the area being 8534¼ acres, and the rateable value about £650,000. He then went on to say that the Corporation have recently finished flood prevention works which have cost £352,000. The drainage area (above Leicester) of the river which has been improved is 147 square miles. The new flood channel will carry off 400,000 cubic feet of water per minute, or 1⅜ inches of rainfall in 24 hours. The length of the principal weir is 500 feet. These works were for the most part designed and carried out by the late Mr. J. Gordon, M.Inst. C.E., and Mr. F. Griffith, M.Inst.C.E.; but they have been completed by the author. The flooding of the town, which in times past was disastrous, is now entirely prevented within the boundaries of the old borough. Storm outfall works, designed by Mr. Mawbey, are now being carried out; the contracts let amounting to £71,447. The main culvert is 8 feet in diameter, and about 3¾ miles long; and it will carry off about 70 million gallons of water in 24 hours from the area built upon of the extended borough. About ten miles of new main intercepting brick sewers and storm outlets are being constructed in the borough. They were designed by the late Mr. Gordon; and, when completed, will have cost, in round figures, £105,000. The sizes of the two main trunk sewers are 7ft. 3in. by 6ft. 3in., and 5ft. 3in. by 3ft. 6in. respectively. Nearly one-third of these works were executed under Mr. Gordon's personal direction; and the carrying out of the remainder, together with the preparation of the working drawings for rather more than half of the works, devolved upon the author as the Chief Engineer. A further loan of £13,400 has recently been sanctioned for additional sewerage works in the added areas. The sewage is treated on the system of broad irrigation. The total area of the farm is 1700 acres, about 1400 of which will be available for sewaging; and they are now being lad out and managed under the author's direction. The total expenditure at present (exclusive of land) sanctioned is £58,900. Mr. Mawbey gave a detailed description of the four independent rotary compound condensing beam-engines, and the eight double-flued Lancashire steel boilers, each 30 feet by 7 feet, working at 80-lbs. pressure per square inch, for pumping the sewage to the Beaumont Leys Sewage Farm through two 33-inch cast-iron rising mains for a distance of about 1¾ miles, and to a height of 164 feet. These, with the engine and boiler houses, workshops, and manager's house, cost £54,970. As the engines can be worked safely at about 15 revolutions per minute, each is capable of developing upwards of 220 actual horse power in water lifted. The total cost of carrying out the various schemes mentioned by the author will be nearly two-thirds of a million sterling. The paper was well illustrated, and contained tables in considerable detail of the results of the trials.

Embezzlement by a Gas Collector at Windermere.—At the Windermere Petty Sessions last Thursday, a young man named James William Graveston was charged on three separate counts with embezzling moneys belonging to the Windermere and District Gas and Water Company and with falsifying the books. Although the prisoner had only been in the employ of the Company about twelve months, there were seventeen different cases discovered against him, amounting in the aggregate to about £20. He was committed to prison for three months, with hard labour.

The Rating of Towns and the Price of Gas.—Mr. George Swainson, the Borough Treasurer of Bolton, has published a table which gives a comparative statement of the rates levied and the prices charged for gas in 58 of the chief towns of the country. Of all the towns in the list, Doncaster is apparently most fortunate. Its Corporation derives a sufficient income from the racecourse to defray all the expenses of local government; and consequently no rates are laid. We presume that gas is not also supplied free of charge, though for some reason in this case, as in two others, Mr. Swainson does not give the price at which it is sold. Newcastle-on-Tyne is credited with supplying gas at the lowest price—viz., 1s. 7·8d. per 1000 cubic feet. Plymouth, where the charge is 1s. 9d.; Gateshead, where it is 1s. 10d.; and Sunderland, where it is 1s. 11d., are the other places at which the charge is under 2s. per 1000 cubic feet. Middlesbrough is supplied at 2s.; and Sheffield, Leeds, and Bury, at 2s. 2d. Of the 55 towns from which returns are made, 30 are being supplied with gas at not more than half-a-crown per 1000 cubic feet; ten more are paying not more than 2s. 9d.; and other seven, not more than 3s. Norwich has the unenviable distinction of being at the head of the list. The price of gas there is 3s. 8d. per 1000 cubic feet. That town is also most heavily rated for its total local charges, which amount, it appears, to 8s. 2d. in the pound, against only 3s. in Lancaster, which, next to Doncaster, is the most lightly-rated borough in the list.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I am sure I but echo the universal feeling, when I express my regret at the announcement of Mr. W. Mackenzie's retirement from the post of Manager of the Dunfermline Gas Company's works. Mr. Mackenzie has been Gas Manager at Dunfermline since June, 1866, before which time he held a similar post at Cupar. Since he went to Dunfermline, the business of the Gas Company has developed enormously—the annual output having risen from 17 to 70 million cubic feet. This retirement breaks the ranks of the veterans in the North British Association of Gas Managers who are still in active service. It is not to be contemplated that he will retire from the Association, for he was the originator of it. It was upon his invitation that a number of gas managers met at Cupar in July, 1862, and formed the Association then known as the Scottish Gas Managers' Association. No fewer than 40 members joined. Mr. Mackenzie was appointed Secretary; and he continued to act in that capacity for 21 years. On resigning the office, he was, at the annual meeting in Edinburgh, in 1882, appointed President. His last appearance in the Association was at the Perth meeting in 1890, when he several times addressed the chair. At the 1891 meeting in Edinburgh, a letter was read apologizing for his absence, on the ground of ill-health, which is also the reason for his retirement. When his resignation was intimated to the Directors this week, they unanimously expressed their regret that it should be necessary to sever the connection which had so long subsisted between them; and they agreed to record in their minutes the high appreciation they had of the manner in which he had discharged his duties during the many years he had filled the responsible post of Manager. Until his successor is appointed, Mr. Mackenzie will continue in office; and his formal retirement is expected to take place at the annual meeting of the Company in May.

The intensely practical paper by Mr. W. Ivison Macadam, of Edinburgh, on "The Relative Illuminating Value of Coal Gas when Consumed from Different Burners and Under Various Pressures," which he read before a meeting of the Society of Chemical Industry in Edinburgh on Tuesday, and of which I have sent you a summary,* contains much that is of interest to the gas manager. In his earlier passages, Mr. Macadam referred to the high pressure maintained upon the mains leading from the Edinburgh gas-works, which, quoting from the 1890-91 statistics of the North British Association of Gas Managers, he showed is equal to 44-10ths; while in Leith, the pressure is only 22-10ths. On that subject, I may be allowed to say that the statistics are not capable of being used as Mr. Macadam used them. They give the maximum night pressure at any part of the system, and do not by any means indicate the general pressure over the area of supply. As is well known, Edinburgh is a city of ups and downs; and a heavier pressure is needed in it, in order to give a supply of gas in some localities, than is the case with a comparatively evenly-disposed town such as Leith. Were it not for the cost of carrying it out, a zone system of mains would, of course, be the most satisfactory for supplying Edinburgh with gas. In default of it, it is of necessity that in some quarters of the city certain of the gas consumers, in order that others who are served off the same main may get a supply, will have too much thrust upon them. It is not the business of the Gas Commissioners, because it is a physical impossibility, to deliver gas to all at the same uniform pressure; all that is required, as it is all that is capable of attainment, is that the general average shall be of a certain and sufficient standard. The Commissioners last year laid an extensive series of mains in the West-end of the city, in order to meet the very evil referred to by Mr. Macadam; and I am much mistaken if the maximum pressure at any part of the system is now so high as his figure. Of the paper as a whole, the most outstanding feature is its thoroughness and completeness. Mr. Ivison Macadam's inquiry into the values of gas lighting was dictated by pure love of science. Except as a private consumer, he has no interest in the question of how much light can be got from a certain quality of gas at a certain pressure; and in this respect, he is unlike a gas manager experimenting on the subject. His experiments were with Edinburgh gas only—that is, gas of from 25 to 26 candle power; and the results he has arrived at may not be applicable to gas of a lower quality. That is a matter which it only requires some scientist like himself, in another district, to take up and determine by exhaustive tests such as he entered into. For all gases of about the quality of Edinburgh gas, he has, however, laid down results which should enable anyone who may be consulted as to lighting to say authoritatively what is the proper burner to use. It is not often that such a valuable contribution towards the solution of problems which sellers of gas find it difficult to solve, comes from one who is outside the ranks of gas manufacturers; and if there were any method of recognition of Mr. Macadam's services—such as the conferring of an honorary membership—the North British Association of Gas Managers might well confer the honour upon him. Mr. Macadam's father (Dr. Stevenson Macadam, of Edinburgh) is already an honorary member of the Association.

The Edinburgh and Leith Gas Commissioners last week purchased a plot of ground, extending to between one and two acres, lying alongside their Leith works, for purposes of extension. The ground has been in the market for a considerable time, and the Commissioners have before endeavoured to purchase it; but hitherto the price asked has been higher than they cared to give. When, however, it was exposed for sale by public auction, they were able to secure it at the upset price of £6500. Some years ago, the Edinburgh and Leith Gas Company wished to acquire the same plot of ground; but their offer of £16,500 per acre was refused. The Commissioners have thus made an exceedingly fortunate purchase. The nature of the extensions for which the ground is to be used has not yet been agreed upon.

The Directors of the Dunfermline Gas Company have approved of plans for the transfer of their works from Rolland Street to Grange Road, where they already have several gasholders. Mr. T. Newbigging is the Consulting Engineer for the new works, which are to be proceeded with at once, and the cost of which is estimated at £17,000. The old works, which are inconveniently situated in the town, are to be abolished. The new site is about half a mile from the town, on the southern side, and is both ample and convenient.

The Kelso Gas Company may now be added to the rapidly growing list of companies in the South of Scotland who have resolved to introduce Mr. Young's oil-gas process into their works. Mr. Scott, the Manager, has received instructions from his Directors to have the plant fitted up immediately. The Directors of the Musselburgh Gas Company, with their Manager (Mr. Thomson), have been to Peebles to see the plant at work; and they propose also to introduce it. Members of the working staffs of both the Edinburgh and the Leith works have been sent by the Engineers of the Edinburgh and Leith Gas Commission to Peebles to observe the working of the process, and take note of the results, with the view of reporting to the Commission as to its adoption, which there is reason to believe will be recommended.

The Dundee Electric Lighting installation is to be formally turned on by Lord Provost Matthewson on Wednesday evening. In connection with the installation, it may be of some interest to state that the proprietors of the *Dundee Advertiser* have arranged with the Gas Commissioners for a supply of electricity to be employed in printing that paper. A motor of 22-horse power is to be used.

The foundation, or rather memorial stone, of a large works for the purification of 10 million gallons daily of the sewage of the city of Glasgow, was laid by Lord Provost Bell on Tuesday. The scheme which has been adopted, after 40 years of talk, is that invented by Mr. G. V. Alsing, and consists of an extensive system of precipitation and aëration, accompanied by treatment with milk of lime and sulphate of alumina. It is said to be in successful operation in Bradford and Sheffield. The cost of the works, which are intended to deal with one-fifth of the city sewage, is estimated at about £50,000.

It is reported that the dissentient shareholders of the North British Water-Gas Syndicate are firm in their determination to resist the proposals for amalgamation with the other two bodies, and that a guarantee fund of over £700 has been collected to cover expenses.

Lords Wellwood and Kyllachy, sitting as Appeal Judges upon questions of valuation, have had before them in the Court of Session a case with reference to the valuation of ammonia plant in the works of the Shotts Iron Company. In 1890, the Company let to Messrs. R. and J. Dempster, of Newton Heath, the right to treat the gases of four close-topped blast furnaces—the Company agreeing to allot ground for the purpose at a yearly rent of £40, and Messrs. Dempster arranging to provide the plant, buildings, &c., necessary for the work. The rent of £40 is entered in the valuation roll; and there was no dispute about it. The lease is for ten years, with continuation. The Furnace Gases Company, of Glasgow, are now in right of the concession to Messrs. Dempster; and the assessor entered them in the valuation roll as proprietors of the ammonia works, at a value of £2500. At the sitting of the Lanarkshire Valuation Committee, in September last, the sum was reduced to £2000; and it was against this sum that the appeal was taken. It was contended for the Furnace Gases Company, that there should be no entry at all of the subjects as against them, as they were merely tenants of the land. For the assessor, it was stated that the agreement with the Shotts Company contained a consideration other than the rent. The works, it was said, produced a revenue of about £2000 a year; and it would be a very curious result if all that was assessable was £40. The Court, following the decision of the late Lord Fraser in the case of the Coltness Iron Company, decided that the tenants could not be entered as proprietors, because they were not proprietors, and they could not be entered as tenants, because the buildings and plant were not let to them. Their Lordships accordingly directed the entry to be expunged from the valuation roll. As it is, the works escape taxation this year. It is likely, however, that an attempt will be made in the autumn to have the Shotts Iron Company entered as proprietors, in virtue of the consideration paid by the occupiers to them for the right to treat the gases, and of the provisions in the agreement as to the Shotts Company taking over the buildings and plant when the lease is terminated. If it be not possible to do this, the "curious result" will be reached of having a valuable property unassessed, by reason of the operation of an agreement between two parties.

* This will be found in our "Technical Record."—ED. J.G.L.

Reduction in the Price of Gas at Ilkeston.—At their meeting last Tuesday, the Ilkeston Corporation resolved, on the recommendation of the Gas Committee, to reduce the price of gas 2d. per 1000 feet.

Exhibitions of Gas Appliances.—An interesting exhibition of gas stoves and domestic labour-saving appliances was held from Monday to Friday last week at Norwich, by the British Gaslight Company, Limited. The gas cooking and heating stoves shown were manufactured by Messrs. Fletcher, Russell, and Co., Limited, of London and Warrington, and Messrs. John Wright and Co., of Birmingham. The other exhibits included modern gas-burners and prepayment gas-meters. Demonstrations on cooking by gas were given by Mrs. Wilkinson each afternoon and evening; and, by desire, on Thursday morning, she lectured on "Sick Room and Invalid Cookery."——An exhibition of gas stoves and appliances was held at Farsley last week; and practical lectures in cookery, both high-class and everyday, were given by Miss Annie Smith, of the Yorkshire School of Cookery.——The Mayor of Stockton (Major Ropner, J.P.) opened an exhibition in the Borough Hall, on Tuesday afternoon, in the presence of a large company. The vestibule was fitted up with a number of gas cooking and heating appliances of the latest designs by Messrs. John Wright and Co., of Birmingham, and Messrs. R. and A. Main, of Glasgow; while in the hall itself Miss Shaw, of Nottingham, proved, each afternoon and evening, the suitability of gas-stoves for all classes of cooking. The exhibition continued over Friday.——There has recently been held at Darlington an exhibition of "Model" ranges and other gas appliances manufactured by Messrs. Richmond and Co., Limited, of Warrington and London. During its continuance, Miss Owen, of South Kensington, delivered lectures, with demonstrations on cookery by means of gas-stoves, which were listened to with much interest.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 11.

Sulphate of Ammonia.—The scale of improvement is being rapidly advanced; and the terse expression "by leaps and bounds" may almost be applied to it, after viewing the increase of the figures during the last few days. But the danger-signal in this unexpected racing must not be overlooked, for clearly the "bull" operators have now seized hold of the market; and it is evidently their intention to drive prices beyond legitimate limits. This is a factor, however, which will have to be dealt with only as regards the future. The market for March delivery at all events is in the hands of those who hold the stuff. The possibility of a famine was adverted to some time ago; and it seems really to have become a *fait accompli*; and it may be said that *never* has sulphate been so scarce. As regards the country, supplies are exhausted, and requirements almost entirely have to be filled from the London market, where some stocks are available; but these, as explained above, will now be held for some extreme prices. Continental consumers are only just waking up. France is now eagerly inquiring; but there is no sulphate to supply her wants, and the same applies to other consuming countries. They have all been waiting till the last moment, anticipating a low range of values as last year; and now they must dolefully listen to the cry "too late." The present course of values must be a great disappointment to the "bear" sellers; it will certainly prove a severe lesson to them. It is almost impossible to fix a price to-day—roughly speaking, it may be called £12. Nitrate is unchanged.

LONDON, *March* 11.

Tar Products.—There is a good deal of inquiry for benzol, particularly for 50's; but buyers will not pay the prices asked by makers. As to 90's, it seems to be losing its parity of value with 50's; and buyers will only pay about 2d. per gallon more for it. The increased production of benzols, on the Continent and in this country, from coke-ovens makes the future of 90's benzol far from a rosy one. Indeed, the opinion has been expressed that 90's will not realize 1s. per gallon, before the end of the year. Pitch is also weak; and, unless the Tar Committee take it seriously in hand, it will see much lower prices. Anthracene is firm, with a good deal of inquiry. Solvent naphtha is moving off a little better; but the value is undoubtedly weaker. Carbolic acid and tar acids are still in urgent demand; large business having been done at the prices mentioned below. To-day's prices are as follows: Tar, 12s. 6d. Pitch, 25s. Benzol, 90's, 1s. 7d.; 50's, 1s. 5d. Solvent naphtha, 1s. 2d. Toluol, 1s. 4d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1d. Creosote salts, 18s. 6d. Carbolic acid, 60's, 2s. 5d.; 70's, 2s. 10½d.; crystals, 7¾d. Cresol, 2s. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia has experienced a most excited market during the past few days; and prices have jumped up from £10 15s. to £12, less 3½ per cent. Unfortunately many makers are heavily sold; and very few of them will enjoy this important advance. Gas liquor is quoted at 7s. to 8s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—As we predicted last week, the question just now occupying most attention in the coal trade of this district is the action which the Lancashire coalowners will take with regard to wages. For some time past, a very strong feeling has been expressed that a substantial reduction has become absolutely necessary; but there is a disinclination to make any definite move in that direction unless the Lancashire coalowners can be satisfied that Yorkshire will also act in conjunction, as the manner in which the colliery owners in this district were a few years back left in the lurch has not yet been forgotten. Consequently it has been decided not to take any definite step in the matter until there has been an opportunity of conferring with the representatives from Yorkshire and other districts—a meeting for this purpose having been arranged to be held in London very shortly. It is exceptional where best Wigan Arley is fetching more than 12s.; Pemberton four-feet and second qualities of Arley, 10s.; and common house-fire coals, 7s. 6d. to 8s. per ton at the pit. The forthcoming gas coal contracts are beginning to occupy attention; and I understand that at a meeting of Yorkshire colliery owners last week, it was decided to make every effort to hold on to last year's prices, as any giving way would be absolutely impossible, unless some reduction in wages could be obtained. The same feeling also prevails throughout Lancashire; but with the very depressed outlook of trade, it would be altogether impossible to forecast what the course of prices may be. Common round coals, if anything, become still more difficult to dispose of, both for inland requirements and for shipment; and business of any weight is so subject to special arrangement as to prices, that it is difficult to give any fixed quotations. Steam and forge coals average 6s. 6d. to 7s. at the pit mouth; whilst good ordinary steam coal, delivered at the ports on the Mersey, does not average more than 8s. to 8s. 3d. per ton. Many of the common coal collieries are not working more than three to four days per week; and this restricted output is lessening the supplies of slack coming upon the market. Prices for engine fuel, however, although steady, show no improvement—6s. to 6s. 3d. being the average for burgy, 4s. 6d. to 5s. for best qualities of slack, and 3s. 6d. to 4s. for medium sorts.

Northern Coal Trade.—A rather fuller demand for coal has set in with the opening of some of the Baltic and other ports; and several of the collieries are enabled to work longer time. Best Northumberland steam coal is now quoted generally at 8s. 6d. per ton f.o.b.; second-class coal is about 6d. less; whilst small steam coal varies from 3s. to 3s. 3d. per ton. In regard to gas coal, a series of large contracts have been settled, or are in course of negotiation. One of those concluded is for Arnheim, and two form parts of a large London supply. The rates at which these have been concluded are generally believed to rule from 5s. 10½d. up to about 6s. 3d. per ton f.o.b.; so that there is a very serious reduction in the price that is to be paid, when compared with the contracts that are expiring. For odd cargoes of coal, there is a fair demand; and the price that is generally quoted varies from 6s. 3d. to 6s. 6d. per ton. Manufacturing coal is dull. Coke is fairly steady at about 14s. per ton f.o.b. for best Durham coke. Gas coke is quiet; but there are some considerable shipments taking place from the Tyne, which help to keep down the stocks in the yards.

Scotch Coal Trade.—This week the Baltic trade has re-opened, which has led to general activity at the eastern ports. Dross and nuts have shown a disposition to rise in price—the supplies being small, on account of the limited output. For other varieties, there is still very little demand, which is attributed partly to the dulness of the iron and allied trades, and partly to severe competition with the North of England. While this is the present state of matters, it is already difficult to get main at so low a figure as last week; and coalowners are unwilling to take forward orders at current rates. It is expected that, all round, the bottom has been reached. The quotations, f.o.b. Glasgow, are: Main, 6s. 3d. to 6s. 6d.; ell, 7s. to 7s. 3d.; splint, 6s. 6d. to 6s. 9d.; and steam, 8s. to 8s. 3d. per ton. The shipments during the past week amounted to 100,939 tons—a decrease of 7619 tons upon the preceding six days, and of 16,757 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 869,288 tons—a decrease upon the total for the same period of last year of 85,476 tons.

John Wright and Co., Limited.—The Directors of this Company propose a dividend of 10 per cent. for the year 1892, with a bonus of 2s. 6d. per share, and the transfer of £4000 to the reserve fund; leaving £2962 to be carried forward.

The New Water-Works for Bath.—At a special meeting of the Water-Works Committee of the Bath City Council, last Thursday week, it was decided to recommend the Council to construct a reservoir capable of containing 50 million gallons at Monkswood, at a cost of £26,500.

Brighton and Hove Gas Company's Bill.—At a meeting of owners and ratepayers of Brighton last Thursday, it was unanimously decided to oppose the Bill now being promoted in Parliament by the Brighton and Hove Gas Company. The object of the opposition is to get "better gas at a lower price."

Plymouth Corporation Water Supply.—At a special meeting of the Plymouth Town Council last Wednesday, it was agreed, in order to secure a more efficient supply of water for fire extinguishing, domestic, and trade purposes, to improve the distribution system at a cost of £11,400.

Proposed Gas Supply for Rostrevor.—The Directors of the Warrenpoint Gas Company recently had a meeting at which they considered a report from Mr. A. Gibb, Manager of the Newry Gas-Works, with reference to the supply of Rostrevor and district with gas, produced either at Warrenpoint or at Rostrevor. This subject has received a good deal of attention from the Directors during the past few months; and the report from Mr. Gibb, who went into the matter thoroughly, has practically brought the question to a decision.

Extension of the West Worthing Water-Works.—We understand that the contract for the construction of the intended high-level service reservoir at Cote, and for the new line of 7-inch main to be laid thereto from the existing pumping-station of the West Worthing Water Company, has been given to Mr. W. W. Smith, of Worthing. Efforts will be made to have these important extensions in full operation before the autumn season. The works have been designed by, and they will be carried out under the superintendence of the Engineers, Messrs. Joseph Quick and Son, MM.Inst.C.E., of Great George Street, Westminster.

Compensation for Damage Caused by a Burst Water-Main.—A case has just been decided by Mr. Verey, one of the Official Referees of the High Court of Justice, in which the West Greenwich Co-operative Society, Limited, claimed compensation from the Kent Water Company, for loss and injury sustained by them through the bursting of one of the Company's mains on Blackheath Hill. A similar action, it may be remembered, was brought by Mr. Bishop, who recovered £1075 (see *ante*, p. 188). In the present case, the defence was withdrawn; and the only matter remaining was the settlement of the damages. The hearing occupied two days; and the result was a judgment for £2013, of which £1484 is an allowance for rebuilding.

Water Supply in Mid-Kent.—At the Athenæum, Malling, last Thursday, Mr. A. F. Bowker, F.G.S., Manager of the Mid-Kent Water Company, gave a lecture on "Water Supply." He explained that water supply came under three heads—(1) that derived from rivers; (2) that which came from upland surfaces or from lakes; and (3) that which was drawn from deep-seated springs. The last was the Company's source of supply; and their scheme was to send out to the district a pure soft water, of which it was greatly in need. Their well at Halling was sunk through the chalk, excluding all water from this formation and the gault, into the lower greensand, which was reached at 375 feet below the surface. The water rose naturally 50 feet, and was lifted by pumps to a height of 250 feet into service reservoirs, whence it flowed by gravitation through about 15 miles of mains.

The Proposed Electric Lighting of Belfast.—Professor Kennedy has just presented to the Gas Committee of the Belfast Corporation his report on the best system of carrying out an electric lighting scheme for the city. He recommends a central and a southern station—the former to supply electric current equivalent to 8500 lamps of 8-candle power each; the latter, 4000 lamps of equal power. The central station is intended for the supply of the business portion of the city. Professor Kennedy is of opinion that there will not be much general demand for the electric light until the scheme is carried out on a larger scale than is contemplated, so as to reduce the price, nor would the proposed installation, he thinks, sensibly reduce the pressure on the existing means of gas supply. He recommends the use of batteries, owing to the varying and irregular load, and for the purpose of economizing both labour and fuel. For similar reasons, he is in favour of employing gas-engines to drive the dynamos. We shall deal further with the report next week.

British Gaslight Company.—The Directors of this Company recommend a dividend at the rate of 10 per cent. per annum, with a bonus of 2s. 6d. per share, both free of income-tax.

East London Water Company.—At the forthcoming half-yearly meeting of this Company, a dividend at the rate of 8 per cent. per annum will be recommended by the Directors; leaving an undivided balance of £14,669.

The Electric Light at Blackpool.—The Local Government Board have sanctioned the application of the Blackpool Town Council for power to raise a loan of £26,000 for electric lighting purposes. The works are already in progress.

Extensions at the Weston-super-Mare Gas-Works.—The Weston-super-Mare Gas Company have recently spent £1428 on account of new purifiers and buildings; these being rendered necessary by the growing requirements of their customers.

The Additional Water-Works for Salisbury.—The Salisbury Town Council have decided to apply to the Local Government Board for a loan of £5200 for water-works purposes, instead of the £4500 originally asked for. Some information respecting the proposed new works appeared in these columns on the 21st ult.

Increased Storeage for the Rochester Gas Company.—The new gasholder which has been erected by Messrs. S. Cutler and Sons at the Gillingham works of the Rochester Gas Company, has been satisfactorily completed. It is a three-lift holder; but provision has been made for a fourth lift when this addition is required.

Electric Lighting for Blackburn.—A Local Government Board inquiry was held at Blackburn last Tuesday week, into an application of the Town Council to borrow £50,000 for electric lighting purposes. A circular was recently issued asking tradesmen if they would adopt the light, if introduced; and it is stated that the response was so unanimous that the Council resolved to proceed at once.

The New Water-Softening Plant at St. Helens.—The buildings and plant which the Corporation of St. Helens commenced to construct in the early part of last year for softening the water supply is now practically completed. The town possesses abundance of water; but its hardness has been a drawback, and for some time it has been a matter of no small anxiety to the Water Engineer (Mr. D. M. F. Gaskin). The hardness of the water originally varied from 7° or 8° to 22°; and it is hoped that it will now be uniformly maintained at 7° or 8°. The process adopted is the Clark-Atkins; and the cost of the building and plant will not exceed £11,325. The contract for the erection of the building was secured by Mr. John Whittaker, of St. Helens; and the machinery has been put in by Messrs. Woodhouse and Rawson, of Kidsgrove.

Sales of Shares.—A number of original £10 and £5 shares in the *Worksop Gas Company* were recently sold by auction, at the highest prices yet obtained. The £10 shares realized £19 10s. and £19 15s.; and the £5 shares, £8 15s. and £8 17s. 6d.——At Maidstone, last Thursday week, sixty shares in the *Rochester, Chatham, and Strood Gas Company* were disposed of by auction. Twenty-four "B" shares of £12 10s. each realized £19 apiece; 18 "C" shares, on which £3 6s. 8d. had been paid, £4 17s. 6d.; and 18 "D" shares, on which £8 10s. had been paid, £18 10s. and £18 15s.——Twelve £10 shares in the *Berwick and Tweedmouth Gaslight Company* changed hands last week at £20 each.——At Preston last week, Messrs. T. Dewhurst and Son offered for sale three lots of shares in local Gas Companies. "B" stock of the *Preston Gas Company* averaged £143 14s. per £100; and fully-paid shares of £10 each in the *Leyland and Farington Gas Company* realized £17 12s. 6d. each.

The London County Council and the East London Water Bill.—At the meeting of the London County Council last Tuesday, Mr. C. Harrison moved that instructions be given to the Parliamentary Agent to oppose, among others, the East London Water Bill and the Crystal Palace District Gas Bill. Alderman Beachcroft, however, opposed the motion, so far as the first-named Bill was concerned. He said he thought Mr. Harrison was taking the unusual course of asking the Council to oppose the second reading of a Private Bill. He moved as an amendment—"That the opposition to the Bill be directed, not to the whole measure, but to such amendment therein as the Council may consider necessary." Mr. Harrison denied that he was proposing an unusual course. It was, he believed, unusual to promote a Private Bill of this kind during the sitting of a Royal Commission. Mr. Benn, M.P., said the Bill was one for raising £500,000 of capital; and it proposed to give the Company power to test and stamp all fittings at the expense of the person fixing them, and to inflict a fine of £5 upon anyone putting in any other kind of fittings after a certain date. This certainly was a new proposal in the history of water companies. On a division, the amendment was rejected by 61 votes to 29; and the Vice-Chairman's motion was then agreed to.

The Recent Subsidences at Sandgate.—Reference was made in the JOURNAL last week to the disastrous subsidences which took place at Sandgate on the 4th and 5th inst., whereby much property was injured, and considerable disturbance of the gas and water mains caused. Last Tuesday, Mr. Walton held an inquiry on the subject, on behalf of the Local Government Board. The catastrophe had been attributed to concussion caused by the blowing up of two vessels which had been wrecked off Sandgate; but the Inspector stated that what he had seen led him to conclude that the catastrophe was due to the sudden release of impounded subsoil water—a thing which he believed was remediable by the institution of proper water-drains. If this was attended to, there was no reason to suppose that such a disaster would ever recur. The whole area wherein it had happened was the result of the previous disturbances. The strata were full of water, which the previous abnormal rainfall had served to increase. That water being released had formed kinds of caverns. The remedies were proper storm and intercepting drains, with free outlets under the road to the sea. By Tuesday last the gas-mains had all been repaired, so that the town could be lighted as usual; and great progress had been made with means for obtaining a temporary water supply from pipes laid along the surface of the ground. The value of the property affected by the subsidences is roughly estimated at £100,000.

Darwen Water Supply.—At Darwen, on the 3rd inst., a Local Government Board inquiry was held regarding an application of the Corporation for the borrowing of a further sum of £15,000 for water-works purposes. The Town Clerk said the money was wanted to carry out the extensions required by an increasing population, and also to pay for the filter-beds which had been erected. The filters had cost about £10,447. Mr. J. Fish opposed the application; holding that greater economy ought to have been exercised by the Local Authority. Mr. Holden, a large ratepayer, supported the application; stating that the management of the water-works during the past two or three years had been appreciated by the town.

Gas Explosion at a Sheffield Conservative Club.—An explosion of gas occurred at the Eccleshall (Sheffield) Conservative Club last Wednesday evening, causing a considerable amount of damage to the building, the erection of which has only just been completed. No one was injured; but practically every pane of glass in the place (of which there were several hundred) was smashed into fragments. The cause of the explosion was an escape of gas. Several gas-jets and two fires were alight in the billiard-room; and a strong smell of gas was noticed, but no action was taken with regard to it. The explosion occurred between the floor boards and the ceiling underneath it, where there must have been a considerable accumulation of gas. The damage is estimated at from £400 to £500.

The Water Supply of Pudsey and District.—Instructions have been given to the Clerk of the Pudsey Local Board to make preparations for undertaking the water supply of Pudsey on the Water Company relinquishing the undertaking at the end of this month. The Calverley and Farsley Boards favour a temporary partnership scheme until final arrangements are made with the Bradford Corporation as to whether the supply shall be received in bulk, or the Corporation shall be asked to supply the district street by street. The Pudsey Board, however, have decided to undertake their own supply separate from the other authorities. Calverley have asked the Corporation to supply their district street by street; but the latter state that they are not in a position to do so at present.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 452.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	"	7½	Do. 7 p. c	10	12—13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	5¾—6¼	..	6 0 0
40,000	5	"	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	214—218*	..	5 5 6
180,000	"	"	8½	Do. New	100	168—173*	..	4 18 3
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	42—44	..	5 4 6
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept	11¼	British	20	42—44	..	5 2 3
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6—7	−1	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98—100	−1	6 0 0
150,000	20	24 Feb.	8	Cagliari, Limited	20	24—26*	..	6 3 1
550,000	Stck.	14 Oct.	12½†	Commercial, Old Stock	100	245—250	+1	5 0 0
165,000	"	"	9½†	Do. New do.	100	187—192	+5	4 18 11
160,762	"	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	125—130	+3	3 9 3
800,000	Stck.	15 Dec	13	Continental Union, Limited	100	227—232	..	5 12 0
200,000	"	"	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	190—195	..	5 2 7
486,090	10	27 Jan.	10	European, Limited	10	21—22	..	4 10 11
354,060	10	"	10	Do. Partly paid	7½	14½—15½	..	4 17 0
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	222—227	..	5 5 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	93—96	..	4 3 4
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	115—120	..	4 3 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	165—170	..	4 8 2
1,300,000	"	"	7	Do. H, 7 p. c. max	100	166—170	..	4 2 4
463,000	"	"	10	Do. I, 10 p. c. Prf.	100	260—265	..	3 15 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	154—158	+1½	3 16 0
1,061,150	"	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	123—126	+1	3 3 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	127—132	..	3 8 2
908,000	"	"	6	Do. 6 p. c. do	100	165—170	..	3 10 4
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	227—230	..	5 4 0
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107—109	..	4 11 9
541,920	20	16 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	10	Oriental, Limited	5	7¾—8¼	..	6 1 2
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	..	7 7 4
166,870	10	—	2	Pará Limited	10	2—2½	..	—
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	and Do.	100	100-105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	9—10	..	—
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	290–295*	..	5 5 0
1,350,000	"	"	12	Do. B do.	100	240–245*	−1	4 17 11
230,000	"	"	13	Do. C do.	100	245–250*	..	5 4 0
750,000	"	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	143—146	..	3 8 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	258—263	..	3 16 1
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	214—218	..	3 13 5
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	141—144	..	3 2 6
700,000	50	15 Dec.	6½	Grand Junction	50	109—112	+1	3 15 10
708,080	Stck.	10 Feb.	11	Kent	100	277—282	..	3 18 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	235—240	−3	3 19 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	195—200	..	3 15 0
285,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	127—132	+2	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	323—328	..	3 14 0
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	+2½	2 18 5
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10p. c. max.	100	161—166	..	3 18 4
126,500	100	"	6½	Do. D 7½ p. c. do.	100	145—150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	260—265	+3	3 15 6

*Ex Div.

† Next dividend will be at this rate.

Calcutta Corporation Water-Works.—The contract for the supply of 48-inch and 24-inch cast-iron pipes has been let to Messrs. James Oakes and Co., of the Alfreton Iron-Works, Derbyshire; and that for the sluice-valves in connection with them, to Messrs. Blakeborough, of Brighouse, Yorkshire. The carrying out of the work is under the superintendence of Messrs. Joseph Quick and Son, MM.Inst.C.E., of Great George Street, Westminster.

The Water Supply of Venice.—The sanitary condition of Venice (says *The Times*) is a matter of importance to a considerable number of English people; and, so far as water supply is concerned, it is discussed in the last report of the British Vice-Consul there. He remarks that it is a great security for the health of Venice that the water of the River Brenta, which was the source of supply to the town, has been abandoned. Owing to the river bringing down sewage and refuse matter, the water was pronounced unfit for drinking purposes. The water now supplied to Venice through the aqueduct is derived from the springs of St. Ambrogio, near Treviso, is conveyed to Venice from the mainland by a conduit under the lagoon, and is then distributed to private houses and public wells through underground pipes. Before 1884, Venice was supplied partly by the water of the Brenta, conveyed to the city in open barges, and partly by rain water collected from the house-roofs in the *pozzi*, or Venetian wells, where it was purified and drawn for use. The difficulty of obtaining drinking water at Venice has from time immemorial made the Venetians very careful in the construction of their wells. A Venetian well consists of a basin more or less wide, according to the conditions of the place, closed all round and at the bottom by a stratum or bank of clay, to prevent the filtration of salt water from the outside. In the inner part of this basin is built a pipe of baked clay, which is placed on a slab of stone laid upon it. The pipe is constructed of circular bricks, joined together with cement of pure clay and sand to render them permeable, so that the water may pass through them into the pipe from the surrounding basin. The basin is then filled with sea sand taken from the dunes, and not with river sand, which putrefies easily. In the inner part of the basin and all round the pipe are constructed the reservoirs in which rain water is collected through exterior perforated slab-stones. These reservoirs are also made of baked bricks, joined together, like those of the pipe, with pure clay and sand, to allow the water with which they are filled to percolate. They are covered with large plates of stone. The St. Ambrogio water now supplied to Venice is of a high degree of purity, needs no filtration, is cool in summer, and is entirely satisfactory to the consumers.

Loan for Gas-Works Extensions at Warrington.—The Gas Committee reported at last Tuesday's meeting of the Warrington Town Council that the Local Government Board had given their formal sanction to the borrowing by the Council of £18,000 for gas-works purposes. The sanction was granted on the undertaking that the loan is repaid within 30 years from the date of borrowing.

The New Water Supply of Florence.—Our readers may remember that, some time ago, Sir Douglas Galton was called in by a Special Committee of the Municipality of Florence to find a supply of pure spring water for the city. The labours of the Committee have now been completed; and the results have been embodied in an exhaustive report. The Municipality would give to a properly-constituted company or syndicate, offering substantial guarantees, the right of supplying water to the inhabitants of the city for 60 years. The sum which would be required to carry out the works is 25 million lire, or, in round numbers, a little less (counting exchange) than a million sterling. The water-rates now produce an annual profit of 300,000frs. But the present quantity is insufficient to satisfy the requirements of the whole population; and it is estimated that, with an abundant supply of water, the present consumption would be more than quadrupled. The city authorities would compel all the present wells of the town to be closed; and thus force the population of the whole commune to use the projected water supply for every purpose. It has been decided that all the waters should come from one source, or group of springs, in order to maintain an unvaried quantity and quality. In the Garfagnana region, some distance beyond the baths of Lucca, there is a spring of water called the Pollaccia, of a delicious, limpid quality. The water has been analyzed, and found to be chemically pure. The surroundings, too, are good; the sources of the spring being at a good altitude, in a rocky, mountainous region, almost bare of vegetation, and free from any possible source of organic contagion. The necessary quantity and quality of excessively pure water having thus been assured in the Garfagnana, where one spring has already been purchased, the Committee recommend the following project: To bring the water from two separate springs, and to add a third when required. The aqueduct would start from Pollaccia, at 550 metres above sea-level. It would then pass through various tunnels and cross several rivers by double syphons, and skirt the edges of mountains above Pescia, Pistoia, Prato, and Sesto to S. Silvestro, above Florence, 212 metres above sea-level, where a reservoir to contain 40,000 cubic metres (about 9,000,000 gallons) would be built. The length of the aqueduct would be 103,245 metres; and the estimated cost 18,000,000 lire.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO., TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

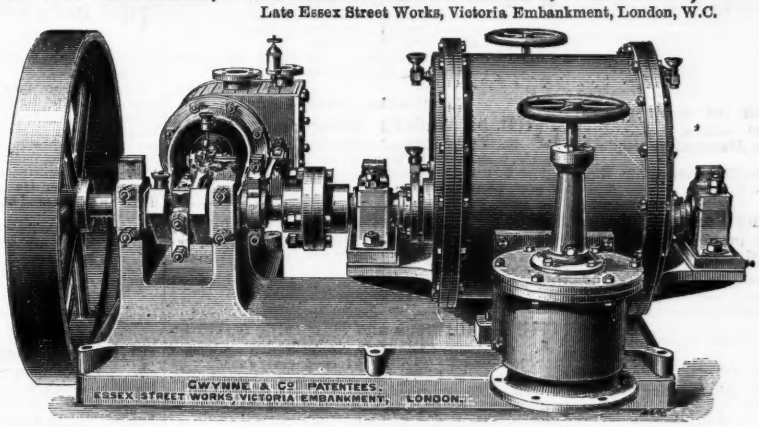
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. III., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. OXIDE PAINT, SULPHURIC ACID, & Chemicals.
130 and 131, NEWGATE STREET, LONDON, E.C.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained free of charge, at their Offices, 80, CHEAPSIDE, E.C.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.

Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, St. Andrew Square, Edinburgh, } Scotland.
Newton Grange, near Dalkeith, }

PORTER & CO., Gowts Bridge Works,

LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "Porter, Lincoln."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical

Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

WANTED, a Situation as Stoker in a small Gas-Works. Accustomed to Engine and Exhauster, and willing to make himself generally useful. Shovel charging preferred. Age 29; married.

Address No. 2209, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a competent Man (aged 40), a Situation as WORKING MANAGER in a small Gas-Works. Sixteen years' experience. Good Stoker, and experienced in Mains and Service laying, fixing Meters, and taking Indices of same.

Address No. 2207, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a Gas-Fitter, a Situation. Used to Meter and Heating and Cooking Stove Fixing, can read Meters, and do General Repairs on Works; also Main and Service laying. Age 27; married.

Address No. 2208, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a practical Man, a Situation as GAS-FITTER, MAIN and SERVICE LAYER. Would take Management of Small Gas-Works. Has had five years' experience in Electric Lighting. Can do wiring, and all repairs necessary. No objection to going abroad. Good reference.

Address No. 2210, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOREMAN required for a Provincial Gas-Works (make 90 million cubic feet). Thorough knowledge of Gas Manufacture requisite. Wages, £2 per week.

Address, in first instance, No. 2212, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Working Foreman, able to take charge of Works (make about 10 million cubic feet per annum); also to fix Meters, and lay Mains and Services.

Apply, stating age, experience, and salary required (free House, Coals, and Gas), with references, to the Secretary, Gas-Works, North Ormesby, Middlesbrough.

COUNTY BOROUGH OF WIGAN.
(Gas Department.)

A METER Inspector required. Appli- cations to be made by letter, giving age and references, to the undersigned.

Jos. Timmins,
Engineer.

Borough Gas-Works, Wigan,
March 8, 1893.

AGENTS wanted throughout England, to represent a Firm manufacturing a GAS-LIGHT, which has an established reputation as being the best in the Market. Sole Agency will be given to an energetic Agent with good local connection. A large and lucrative business to be done if properly worked. Most favourable terms, whereby a good income can be secured to suitable persons. First-class references required.

Apply (envelope marked "Agency") to Star, Hart's Advertising Offices, 17, Arundel Street, Strand, W.C.

DUNFERMLINE GASLIGHT COMPANY, LIMITED.

THE Directors of this Company desire the services of a competent person to act as MANAGER and TREASURER of the Company's Works and Business, to devote his whole time to his duties.

Applicants must have had experience in construction and erection of Apparatus, and complete knowledge of the most modern methods of Carbonization, and Gas Purification and Distribution. The present annual make of Gas is about 70 million cubic feet.

Applications, stating age and experience, and accompanied with testimonials, to be addressed to the Chairman, at the Works, on or before the 10th of April next; the person appointed to be prepared to enter on his duties on the 1st of June next.

Gas-Works, Dunfermline,
March, 1893.

TO INVENTORS AND OTHERS.

PATENTS for Inventions Secured and TRADE MARKS REGISTERED throughout the World. Advice on all matters connected with the above. Handbook gratis on application.

J. C. Chapman, C.E., Chartered Patent Agent, 70, Chancery Lane, London.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.

John Spencer, Globe Tube Works, Wednesbury; and 14, Great St. Thomas Apostle, London.

WANTED, a good second-hand AMMONIA STILL and SATURATOR.

Reply, stating size and price, to Mr. J. M. Gartside, Government Gas-Works, Camberley, Surrey.

WANTED, a second-hand Sulphate STILL, about 2 feet diameter, and SUPER-HEATER.

Address Henry Tobey, Gas-Works, Malton, Yorks.

WHAT Offers for 50 or less number of £10 SHARES (£7 10s. paid up) in FLETCHER, RUSSELL, AND CO., LIMITED.

Address No. 2205, care of Mr. King, 11, Bolt Court, Fleet Street, London.

FOR SALE—Ten 16-inch round RETORT MOUTHPIECES, with Lids, and Ten 6-inch to 4-inch ASCENSION-PIPES.

Apply to the Secretary, Gas Company, Cannock, Staffs.

FOR SALE—Rectangular Station Meter. Capacity 19,000 cubic feet per hour; 12-inch Connections.

For particulars apply to W. E. Price, Gas-Works, Hampton Wick.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.

For further particulars, apply to Mr. T. G. Marsh, 41, Corporation Street, Manchester.

EXHAUSTER FOR SALE.

ONE of Waller's Three-Blade Rotary EXHAUSTERS of 10,000 cubic feet per hour. Can be seen at work; being replaced by a larger one.

For further particulars, apply to Mr. Cooper, Gas-Works, Banbury, Oxon.

SCRUBBER for Sale, 6 feet diameter, with Spiral Staircase, Gallery, House, Connections, &c., complete, made by Messrs. C. & W. Walker. In good condition.

Apply, by letter, to No. 2211, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE Ballymena and Harryville Gaslight Company, Limited, invite TENDERS for from 1500 to 1700 tons of Best Screened GAS COAL, free on Waggons at Larne Harbour, to be delivered before the 1st of November next.

Payment to be made on the first Monday in March, 1894.

Tenders to be lodged with me on or before Monday, the 27th of March.

T. C. C. Hood,
Secretary.

Ballymena, March 9, 1893.

WEST HAM GAS COMPANY

SEA-BORNE COALS.

THE Directors invite Tenders for the supply of GAS COALS of good quality for One, Two, or Three Years from the 1st of July, 1893. Requirements, 40,000 to 50,000 tons per annum.

Tenders to be received by the 20th inst.

Full printed Particulars and Form of Tender may be obtained of the undersigned.

A. G. Snelgrove,
Secretary.

West Ham Gas-Works, Stratford, E.,
March 9, 1893.

MARSDEN LOCAL BOARD.

THE above Board invite Tenders for a TRIPLE TELESCOPIC LIFT GASHOLDER. The Diameter of the present Holder is 60 feet and depth 14 feet.

Parties tendering must furnish Specifications and Drawings, and state time in which they can complete the contract.

Tenders to be delivered to the undersigned on or before the 22nd inst.

Jas. C. Farrar,
Clerk to the Board.

Marsden, near Huddersfield,
March 3, 1893.

SADLER AND CO., LIMITED, Middlesbrough; Ulverston (Barrow); Portsmouth; Carlton; Stockton; 315, St. Vincent Street, Glasgow; 10, Marsden Street, Manchester; and 85, Water Street, New York. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: Middlesbrough. Correspondence invited.

PATENTS: Some Popular Delusions. By W. Lloyd Wise, Esq., J.P., C.C., Fellow of the Chartered Institute of Patent Agents, London. See CALVERT'S MECHANIC'S ALMANAC for 1893. Price 4d.

Manchester: John Heywood, Deansgate; and John Calvert, 99, Great Jackson Street. London: John Heywood, 2, Amen Corner.

TENDERS FOR COAL TAR.

THE Littleborough Gas Company are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works from April 1, 1893, to March 31, 1894.

Tenders to be sent in to the undersigned not later than the 28th inst.

John Cockcroft,
Secretary and Manager.

Gas-Works, Littleborough,
March 8, 1893.

OUNDLE GAS COMPANY.

THE Directors of the Oundle Gas Com- pany are prepared to receive TENDERS for a GASHOLDER, 45 feet in diameter, to be erected at their Works at Oundle.

Plans and Specifications may be seen on application to the Secretary of the Company at Oundle, or to Mr. John Eunson, C.E., Northampton, on or after Saturday, March 11.

Tenders, addressed to the Chairman, to be delivered to the Secretary of the Gas Company, on or before the 23rd day of March inst.

The Directors do not bind themselves to accept the lowest or any tender.

Robt. Knight,
Secretary.

New Street, Oundle,
March 6, 1893.

TENDERS FOR TAR.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR they will have for disposal during the Twelve Months ending March 31, 1894—viz., about 2100 tons.

The Company may dispose of the total surplus of approximately 2100 tons, or part thereof, in one or more Contracts, extending over Six or Twelve Months, as the Board may decide; but they do not bind themselves to accept the highest or other tender or tenders.

Tenders must be addressed to the Chairman of the Finance Committee of the Derby Gaslight and Coke Company, Friar Gate, Derby, endorsed "Tender for Tar," and delivered on or before Tuesday, the 28th day of March, 1893.

Further particulars may be had on application.

By order of the Directors,
Richard Fisher,
Secretary.

Derby Gas Office,
March 9, 1893.

CITY OF BELFAST.

THE Gas Committee of the Belfast Cor- poration invite TENDERS for the supply and Erection of RETORT-FITTINGS, including Mouthpieces, Hydraulic Mains, Ascension and Arch Pipes, Furnace-Doors, &c., &c.

Drawings and Specification, may be inspected at the Engineer's Office, Gas-Works, Belfast.

Copy of Specification, with Form of Tender attached, can be had on payment of One Guinea, to be returned on receipt of a *bonâ fide* Tender.

For the convenience of parties unable to inspect plans at the Works, it has been arranged to supply a complete set of Drawings and Specification on payment of Three Guineas (not returnable).

Tenders, endorsed "Tender for Retort-Fittings, &c.," must be lodged in the Town Clerk's Office, Town Hall, Belfast, not later than Wednesday, the 29th of March, 1893.

The Committee do not bind themselves to accept the lowest or any offer.

James Stelfox, Engineer.

SOUTH SHIELDS GAS COMPANY.

TO METER MANUFACTURERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of DRY GAS-METERS required during the present year.

The Meters must be of best quality, and delivered at the Gas-Works, carriage paid.

The Directors do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained at the Gas-Works on application to Mr. W. J. Warner, the Engineer.

Tenders, marked "Tender for Meters," to be delivered to the undersigned not later than Friday Morning, the 17th inst.

J. H. Penney,
Secretary.

Gas Offices: Chapter Row,
South Shields, March 4, 1893.

TAR AND AMMONIACAL LIQUOR.

THE Gas Committee of the Padiham and Hapton Local Board invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR to be produced at the Gas-Works during the Year ending March 25, 1894.

Sealed tenders, addressed to the Chairman, Gas Committee, Local Board, Padiham, must be sent to me not later than Saturday, March 25, 1893.

For particulars, apply to the undersigned.

J. R. SMITH,
Clerk to the Board.

Padiham,
March 9, 1893.

ULVERSTON LOCAL BOARD.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of 600 yards of 3-inch Turned and Bored PIPES, 50 tons of OXIDE OF IRON, and STORES required during the Year ending March 25, 1894.

Also for the supply of B.O.V. made from Brimstone or Spent Oxide, strength not less than 144° Twaddel, delivered at Ulverston Station, during the year ending the 25th of March, 1894.

Specifications, Schedule, and Form of Tender may be had on application to the undersigned.

Tenders, properly endorsed, to be sent in, addressed to the Chairman of the Gas and Water Committee, not later than the 28th inst.

JNO. SWAN,
Engineer and Manager.

March 11, 1893.

EAST LONDON WATER-WORKS COMPANY.

NOTICE is hereby given, that the HALF-YEARLY ASSEMBLY of Proprietors will be held at the Company's Office, St. Helen's Place, Bishopsgate, E.C., on Monday, the 27th of March, 1893, at Twelve o'clock Noon precisely, pursuant to Act of Parliament.

The Transfer Books in respect of the Ordinary Stock will be closed on the 20th of March inst., and re-opened on the 10th of April, on which day the Dividends on this Stock will be payable.

By order,
I. A. CROOKENDEN,
Secretary.

St. Helen's Place, E.C.,
March 9, 1893.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is hereby given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office, on Wednesday, the 29th inst., at half-past Twelve o'clock precisely, to transact the usual Business, and to declare the Dividend for the Half Year ended the 31st of December last.

Notice is hereby also given, that the Transfer Books of the Company will be closed on the 18th and re-opened on the 30th inst.

By order of the Court of Directors,
FREDERIC LANE LINGING,
Secretary.

Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.,
March 10, 1893.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is hereby given, that William COWAN, of Buccleuch Street Works, Edinburgh, in the County of Midlothian, N.B., has applied for LEAVE TO AMEND THE SPECIFICATION, filed in pursuance of the application for Letters Patent No. 18,855 of 1892, for "Improvements in Automatically Varying the Load and Pressure of Gas Governors, and in the Means or Apparatus employed therefor."

Particulars of the proposed Amendments were set forth in the 'Illustrated Official Journal (Patents)," issued on the 1st of March, 1893.

Any person may give notice (on Form G) at the Patent Office, 25, Southampton Buildings, London, W.C., of opposition to the Amendment within One Calendar Month from the date of the said Journal.

(Signed) H. READER LACK,
Comptroller General.

Messrs. Johnsons,
Chartered Patent Agents,
115, St. Vincent Street, Glasgow,
Agents for the Applicant.

BRISTOL WATER-WORKS COMPANY ORDINARY STOCK.

ALEXANDER DANIEL SELFE & CO. will sell BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, the 23rd day of March, 1893, at Two o'clock in the Afternoon, £20,000 BRISTOL WATER-WORKS SEVEN PER CENT. MAXIMUM ORDINARY STOCK, which will be offered in convenient Lots of £160 Stock and upwards, at the reserved price of £185.

The above £20,000 of Stock is part of the 7 per cent. Maximum Ordinary Stock, amounting to £240,000, created under the powers of the Bristol Water-Works Act, 1888.

The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full; but such diminution may be made up in subsequent years.

The Dividend on this Stock for 1891 and 1892 was £5 5s. per cent. per annum, at which rate of Dividend Stock purchased at £135 per £100 Stock would yield £3 17s. 9d. per cent. per annum.

For further Particulars and Conditions of Sale, apply to the AUCTIONEERS, Bank Chambers, Corn Street, BRISTOL (and 34, Old Jewry, LONDON, E.C.); to Messrs. FUSSELL AND Co., Solicitors, 36, Corn Street, BRISTOL; or to Mr. ALFRED J. ALEXANDER, General Manager, Bristol Water-Works Office, Small Street, BRISTOL.

For the convenience of Stock Brokers, Solicitors, Executors, and the Public.

SPECIAL SALES BY AUCTION
OF
STOCKS, SHARES, AND DEBENTURES
IN LOCAL GAS AND WATER COMPANIES, ASSURANCE OFFICES, BREWERIES, TRADING CONCERNS, AND OTHER SIMILAR SECURITIES, *specially such as are not otherwise readily dealt in,*
TAKE PLACE AT THE MART DURING THE YEAR 1893,
BY
MESSRS. EDWIN FOX AND BOUSFIELD,
On the following WEDNESDAYS in each Month:—

April 5.	*July 5.*	*Oct. 4.*
May 3.	*Aug. 2.*	*Nov. 1.*
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Inclusive Commission fixed on receiving instructions.
For Estate Auction Advertisements, see Saturday's *Times*.
99, GRESHAM STREET, BANK, LONDON, E.C.

Price 6s., Cloth Bound, Bevelled Boards.

THE
GUIDE-FRAMING OF GASHOLDERS
AND OTHER PAPERS
CHIEFLY RELATING TO
STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY
F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**
ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
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THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

NIDDRIE CANNEL
A FIRST-CLASS CANNEL COAL,
Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO
The Niddrie & Benhar Coal Co., Ltd.,
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EDINBURGH.
Telegrams: "BENHAR, Edinburgh."

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Danish Gas Company of London, Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.,

London: WALTER KING, 11, Bolt Court, FLEET ST., E.C.

AUG. KLÖNNE,
DORTMUND (GERMANY).
REGENERATIVE FURNACES.
Unsurpassed in
Efficiency, Economy, Durability, and Easy Working.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on application

HYDRATED OXIDE OF IRON
FOR GAS PURIFICATION.
Two to three times as rich in Hydrate as Bog Ore.
STRONG ACTION ON SULPHURETTED HYDROGEN.
We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.
LESS THAN HALF THE PRICE OF BOG ORE.
APPLY TO—
READ HOLLIDAY & SONS, LTD., HUDDERSFIELD.

HARPER & MOORES,
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MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

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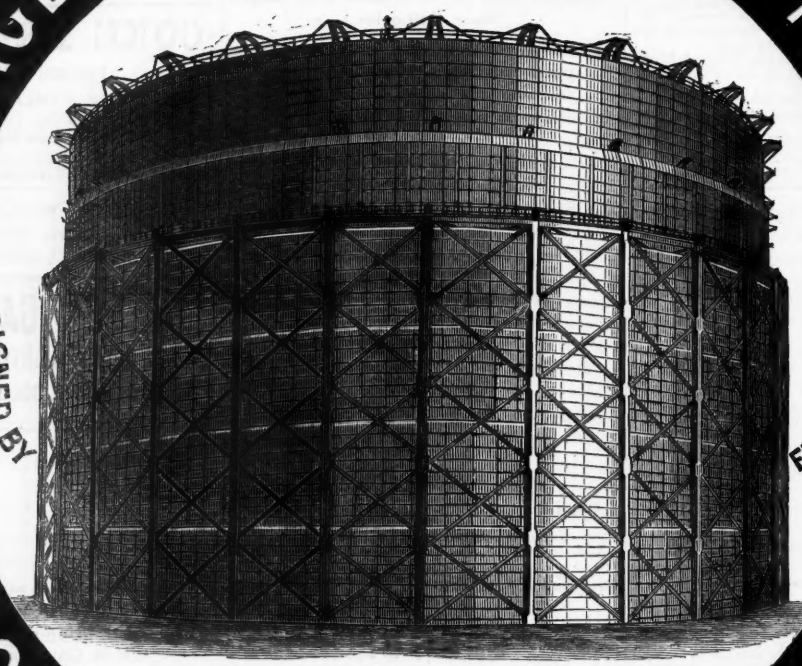
THE LARGEST GASHOLDER IN THE WORLD
GASHOLDERS OUR SPECIALITY



DESIGNED BY FRANK LIVESEY ESQ
CAPACITY 12 MILLION CUBIC FT.
ERECTED AT EAST GREENWICH FOR THE
South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR
MAKERS OF GAS PLANT OF EVERY DESCRIPTION
ROOFS PURIFIERS &c. ALSO
ADDRESS LONDON 60, QUEEN VICTORIA ST.
TELEGRAPHIC "GAS, LEEDS."
GASHOLDERS OF ANY SIZE
ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

TROTTER, HAINES, & CORBETT,

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FIRE-CLAY & BRICK WORKS,

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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

THE SILICA FIRE-BRICK

COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, near DEWSBURY.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

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REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

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JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, Limited,

Sheaf & Spring Works,

SHEFFIELD,

MANUFACTURERS OF

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FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

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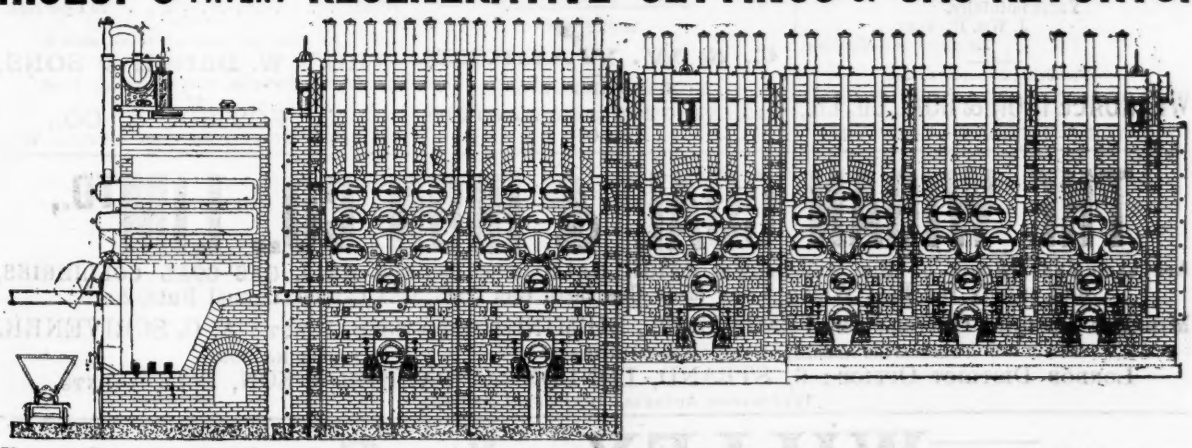
HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth,*
January 25th, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,
NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL**, received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{5}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{5}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The **ILLUMINATING POWER** averages from 11 daily tests, **16·54 CANDLES**, which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.,
QUAYSIDE, NEWCASTLE-ON-TYNE.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

TAR.

GAS COMPANIES should not sell at the present low price, but use it for heating their Boilers or Retort-Settings with

WALKER'S

PATENT

SPRAY BURNER.

Its Heating Value is Twice as Great as Coke.

APPLY TO

C. & W. WALKER,
MIDLAND IRON-WORKS,
DONNINGTON, near NEWPORT, SALOP.

NEW **BOX'S** PATENT.

RETORT LID-FASTENER.

CANNOT GET OUT OF ORDER.
DOES NOT DAMAGE LIDS.
SIMPLE & EFFECTIVE—CHEAP & DURABLE.
For Prices and Particulars, apply to
W. W. BOX, Gas-Works, Crayford, Kent.
[*Illustrated Description in* JOURNAL, *Vol. LX., p. 346.*]

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE.
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

WILLEY & Co.,

Gas Engineering Works, Commercial Road, Exeter,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS. WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

THE CHARLES HUNT GAS WASHER

(HUNT'S PATENT).

By this Washer, which performs the functions of both a Washer and Scrubber, any tarry matters are intercepted, and the whole of the Ammonia is removed from the Gas, together with a high percentage of Carbonic Acid and Sulphuretted Hydrogen.

This is effected by causing the Gas to pass in finely-divided streams through a series of light seals, formed by inverted troughs, having their perforated sides submerged in liquid, and placed one above another. Clean Water being introduced at the top and flowing from tier to tier in the opposite direction to the Gas, leaves the Washer at the bottom as strong Ammoniacal Liquor.

The lower tiers perform the function of a most efficient Tar Extractor, removing from the Gas all traces of tarry matters.

The total back pressure due to this apparatus does not exceed about 7 ins.

The advantages claimed for the Washer are: **It is entirely automatic in action**, depending only upon a constant supply of clean water, proportionate in quantity to the volume of Gas passing. **It has no moving parts**, and thus **no driving machinery or power** is required other than a slight extra duty thrown on the Exhauster. **It is economical in first cost**; there is **practically no wear and tear**; and consequently **no expense for maintenance**. It is **compact in form, occupies little space, and requires no heavy foundations.**

For prices and particulars apply, stating capacity required, to the Sole Makers, Messrs. S. CUTLER & SONS.

GAS CONDENSERS

MORRIS & CUTLER'S PATENT CONDENSER

IS IN USE AT OVER 80 GAS-WORKS.

It is Independent of Atmospheric Temperature,
Prevents the Formation of Naphthaline,
Is Readily Adjusted to Condense varying makes of Gas,
Acts as a Frictional Tar-Separator,
Efficient, Compact, Convenient, Ornamental.

Sole Makers, Messrs. S. CUTLER & SONS.

GASHOLDERS of EVERY SIZE and TYPE.

SAML. CUTLER & SONS, MILLWALL, LONDON.

Westminster Office: 16, GT. GEORGE STREET.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS,
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
8-X 0	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
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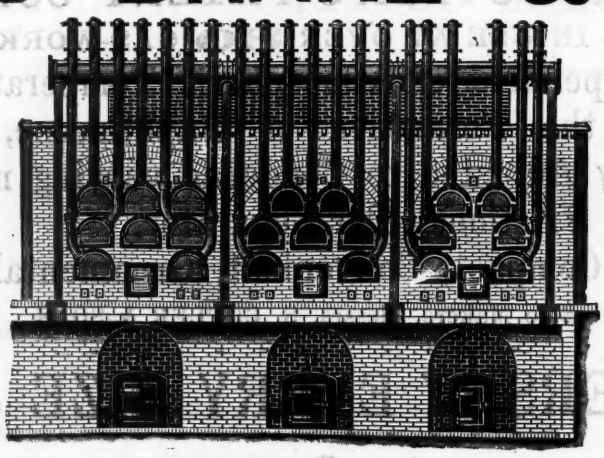

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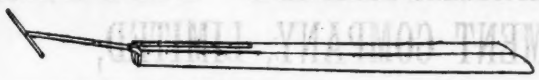

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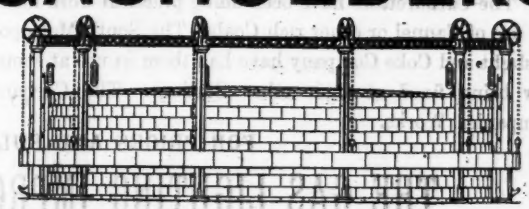

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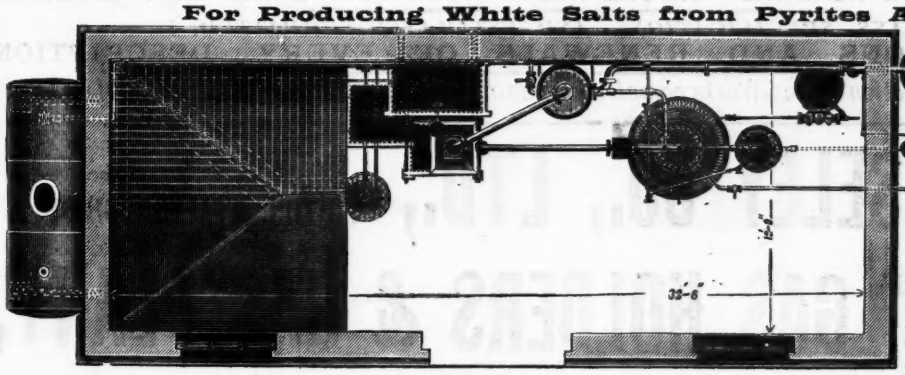

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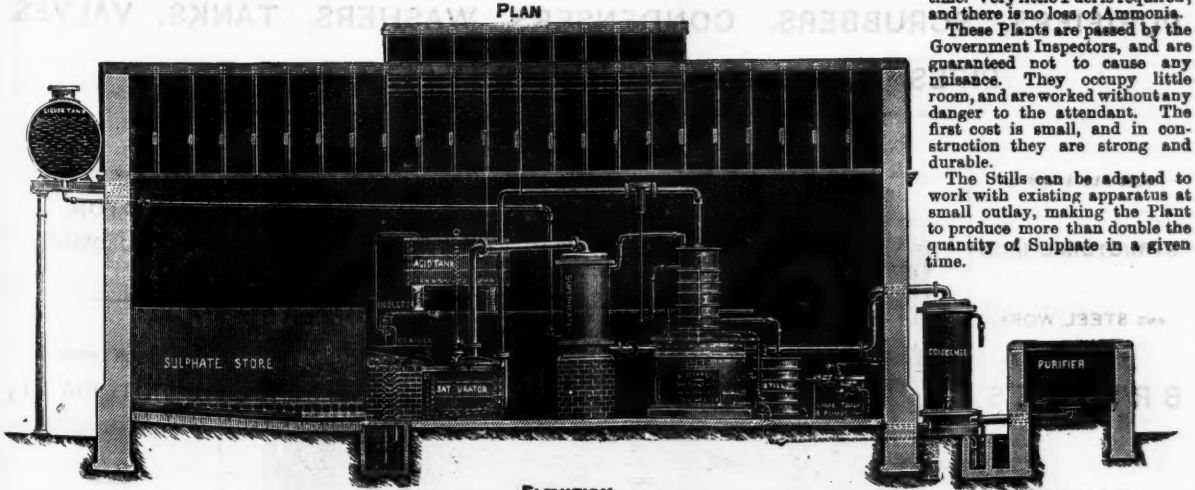

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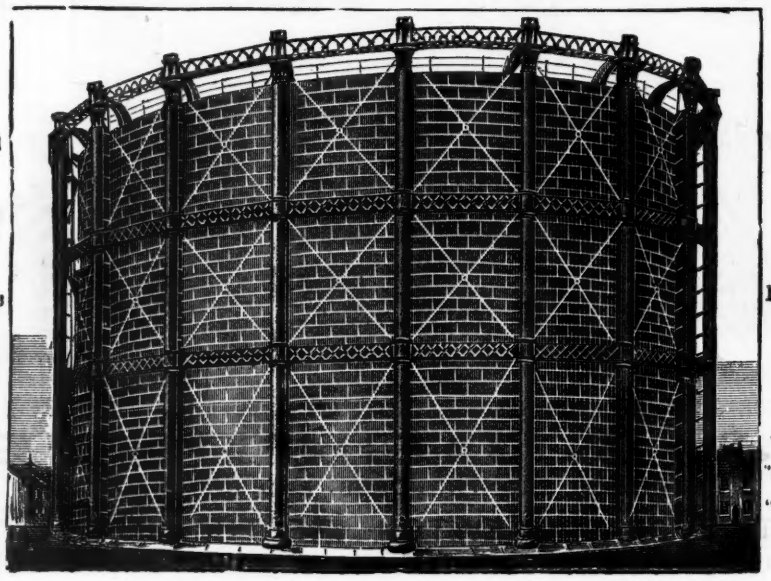

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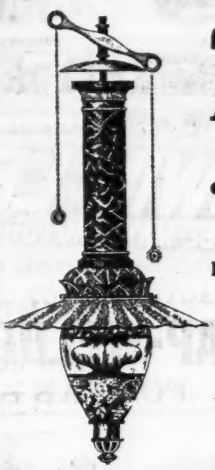

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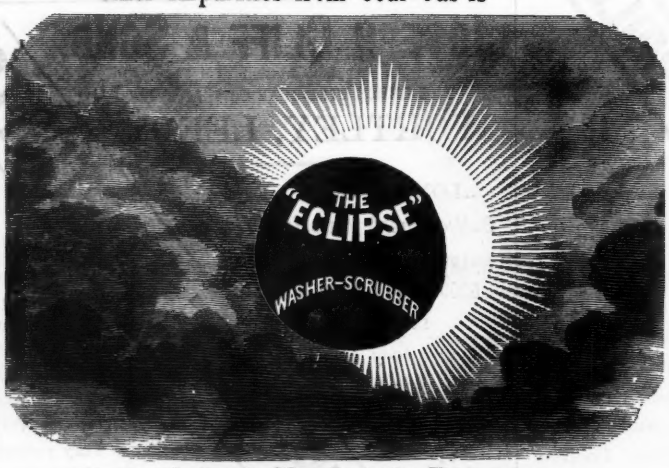

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